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EDUCATIONAL APPLICATIONS OF MANAGEMENT GAMES. FINAL REPORT.

BY- STROTHER, G.B. AND OTHERS

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THE USES OF MANAGEMENT GAMES FOR EDUCATIONAL PURPOSES WERE STUDIED, AND THE METHODS USED AND RESULTS OBTAINED WERE PRESENTED. SEVERAL INVESTIGATIONS WERE UNDERTAKEN AND RESULTS REPORTED--(1) A QUESTIONNAIRE SURVEY AND PERSONAL INTERVIEWS INDICATED THAT MANAGEMENT GAMES WERE GENERALLY USED TO SYNTHESIZE THE STUDENT'S PREVIOUSLY ACQUIRED KNOWLEDGE, (2) AN ATTITUDE TEST AND A FACT AND CONCEPT TEST WERE ADMINISTERED BEFORE AND AFTER THE MANAGEMENT GAMES WERE PLAYED, AND THE RESULTS FAILED TO SHOW ANY STATISTICALLY SIGNIFICANT BENEFITS FROM THE GAME EXPERIENCE AT EITHER THE UNDERGRADUATE OR GRADUATE LEVEL, AND (3) OBSERVATIONS OF THE SUBJECT'S BEHAVIOR IN MANAGEMENT GAME SITUATIONS INDICATED TO THE AUTHOR THE IMPORTANCE OF INTERPERSONAL RELATIONSHIPS TO THE STUDENT'S ABILITY TO LEARN FROM THE GAME. THE REPORT ALSO CONTAINS A COMPLETE DESCRIPTION OF A SIMPLE MANAGEMENT GAME INCLUDING STRUCTURAL EQUATIONS COMPUTING PROCEDURE. (LB)

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Final Report

Educational Applications of Management Games

August 31, 1966

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Educational Applications of Management Games.

Final Report.
August 31, 1966

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CHAPTER I

INTRODUCTION

A. The Problem

Increasing interest and widespread use of management games is being evidenced in university education. Known variously as business games, or business simulations, as well as management games, they represent a use of the electronic computer and modern simulation techniques as educational media.

A typical management game represents a simulation of a number of firms competing, in an industry, for sale and profits. A single person or a small group of individuals, acting as the top management of each of the simulated firms, make various decisions during each of the simulated time periods. The result of the decisions are determined according to a set of logical and mathematical relationships, called a model, which represents the interaction between decisions of the individual firms and their environments.

Since the interaction between the decisions and the environment is complicated in even the most simple of games, an electronic computer is usually used to calculate the results of each simulated decision period. The most important job of the computer is, however, to provide the participants with the results of the decisions made for the period. This feedback, which takes the form of typical business reports, provides the players with new information which may be used in subsequent decisions.

The management game has been likened by some to role playing or dynamic case studies in which the distinguishing feature is the existence of a cybernetic system where feedback influences both subsequent decisions and the environment in which those decisions are made. The number and type of decisions, the business periods simulated, and the degree of player interaction and competitions varies among the various games but the basic core of all games is this interaction between the players and the environment.

While the historical roots of management games can be traced to the military war games, the immediate history dates only from 1956 when the American Management Association produced its "Top Management Decision Simulation." Despite the relatively short intervening period of time, there is today a large number of games in general use, both in adult education programs and in college classrooms. A number of the major business schools have incorporated games in one form or another into their over-all program for training students. Despite this sudden widespread popularity and the enthusiastic reports from the proponents of management games, practically no empirical research has been conducted and educational merits of gaming are largely a matter of conjecture.

The rapid expansion of gaming influence upon higher education and the sizable cost involved in developing and utilizing management games makes it vital that experimental research be conducted to evaluate their usefulness as a teaching medium in the college environment.

B. Outline of the Study

The research conducted for this study was an attempt to provide some objective evidence on the efficacy of gaming in college education. Section II reveals the present state of gaming: The literature is reviewed followed by a discussion of a survey and telephone interview designed to find out current work on management games. The emphasis of the survey and interview is on the administrative aspects of games.

Section III is devoted to the problem of measurement of the effects of games. An attitude questionnaire and a fact and concept test are developed.

Some experiments with management games are discussed in sections IV, V, VI, VII. Section IV evaluates the effectiveness of a simple management game used as an adjunct to an undergraduate course. In section V, the effects of using a complex game with undergraduates are discussed. The results of an experiment using a complex game integrated into a graduate course are discussed in section VI. Finally section VII describes the use of a simple game in studying group influence on decision making.

The summary of the research findings appears in section VIII. Section IX contains a detailed description of the simple game used in the experiments.

CHAPTER II.

THE PRESENT STATE OF MANAGEMENT GAMING

by

A. C. Johnson, P. A. Gruendemann, and H. E. Thompson

A. Objective of The Research Project

The major objectives originally set down to guide the research project were three fold:

1. To identify potential applications of management gaming to the college curriculum.
2. To determine the factors which influence game effectiveness in a business curriculum.
3. To evaluate the effectiveness of management games as a teaching media.

In order to meet these objectives a research program was designed to be accomplished within the two year constraint of the project. The program was composed of literature review, survey, and experimental research. The literature review and survey were primarily designed to meet objectives 1 and 2. The experimental research was intended to further meet objective 2 while concentrating on objective 3.

In the present chapter we will present a review of the reported literature concerning management games with regard to objectives 1, 2, and 3. Following the literature review the results of a comprehensive survey of users of management games will be reported.

Before proceeding to these two parts we will discuss the background and general philosophy of the use of management games.

B. A Short History and Philosophy of Gaming

The use of games in education for business management dates back to 1956 when the AMA introduced the first business management game[1] although the concept is much older being a direct outgrowth of military war games.[2] Following the AMA game the development of games was rapid. By 1962 Greenlow, Herron, and Rawdon were able to report detailed summaries on eighty-nine games.[3] These games range from those that can be played much as parlor games to those that require extensive use of electronic computers. Their areas of application run from wholesale liquor management to bank management.[4]

Although business games are in many ways similar to case study, role playing, and "incident" methods of business education, they are distinguished in one important aspect--feedback. Whereas the traditional methods are primarily static in nature, the business game with its emphasis on the effects of decisions overtime is dramatically dynamic. Two identical business situations can be presented to two different groups in the form of a business game and it is quite likely that after the passage of time each group will be reacting to a different environment.

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[1] Ricciardi et al., Top Management Decision Simulation: The AMA Approach, American Management Association (New York, 1957).

[2] Anonymous, The Game of War, Technical Operations, Inc., 1960.

[3] P. S. Greenlow, L. W. Herron, R. H. Rawdon, Business Simulation In Industrial and University Education, Prentice-Hall 1962.

[4] Ibid., pp. 270-341.

Most general business games involve a separation of the participating group into separate "teams" each of which serves as the top management of a firm. These teams then compete in a common market simulating the actual operation of a competitive firm. The participants are provided with three types of experience. First, since each team is usually made up of more than a single person, there is experience in interpersonal relations. In the second place participants gain experience in the internal operations of business firms. Finally the interaction between competing firms provides experience in the economics of markets.

Functional business games have a much more limited scope. Although they involve feedback they are primarily concerned with internal operations of a particular functional area in a business firm such as production or marketing. It is much more likely that a functional game will not involve interpersonal relations or markets.

The main purpose of games, whether they are functional or general, hand calculated or computerized, is to provide a degree of experience or pseudo-experience which will prove useful in understanding the complex nature of the business enterprise. The question of how well games succeed can only be given a relative answer in terms of alternative uses of the students' valuable time. This then leads to our objectives previously stated. Where can the games be used? How can they be used? How do they compare with other methods of teaching? These are the questions which we will attempt to analyze in the succeeding sections of this report.

In the next section, Review of the Literature, we will seek answers to the questions of where and how games can be used. Following the review of the literature the results of a survey of the current work with management games will be presented.

C. Review of the Literature

1. The Development of Games.

The first game to be reported in the literature was the American Management Association's Decision Making Simulation which was introduced in 1956 and incorporated into the AMA's program in 1957.[5] It was a computerized general management game which served as a model for the development of the many games which followed.

At the AMA seminar company executives make decisions on selling price, how much to spend on marketing activities, how much to allocate to research and development budgets, production rates, expansion of plants, and how much to spend to purchase market research about their customers' expenditures. This decision set served as a model in the succeeding development of general management games.

Another precedent was set when the AMA limited the time available to make decisions. This approach was used by many game operations until games began to be incorporated into academic programs. Because of class schedules this approach was eventually abandoned for the use of games over longer periods of time.

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[5] Ricciardi, et al., _op_. _cit_.

The basic structure of the mathematical functions describing such things as market share was carried over from the AMA game into games which followed.

In early 1958 the first hand computed general management game appeared in the Harvard Business Review.[6] It was undoubtedly responsible for the widespread interest in management games which followed.

As previously stated, by 1962 Greenlow, Herron, and Rawdon were able to provide a detailed description of eighty-nine games. It is quite clear that there were many more games in existence at that time than was reported. However a quick look at the games will provide some insight into their applications as of 1962.

As shown in figure 1,46 of the games were general management or total enterprise games while 43, or less than half, were functionally oriented. In turn the functionally oriented games were largely for production and marketing with less than one-fifth of the functional games in other business areas. This discrepancy suggests that the areas of production and marketing offer advantages for potential applications of management games which are not present in other functional areas.

When one examines the characteristics of the production area the following distinguishing characteristics are apparent:

1. Physical arrangements of production facilities are complex and varied.

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[6] Andlinger, G. R., "Business Games -- Play One!" Harvard Business Review, March-April 1958.

2. The area deals with measurable quantities to a much greater extent than any other area of business management. There is, in addition, a long history of successful measurement of these quantities dating from F. W. Taylor.
3. Outside of accounting the first business applications of computers were in production management.
4. The great bulk of industrial operations research has been done in the area of production.
5. A large percentage of the students, scholars, and practitioners of production management have some training in engineering of the physical sciences.

Figure 1

Classification of Games by Application*

	General Management	Production	Functional		Personnel	Others	Totals
			Marketing	Finance			
Computer	23	8	9	1	0	2	43
Manual	21	15	5	4	1	0	46
TOTALS	46	23	14	5	1	2	89

Figure 2

Classification of Games by Developing Organizations*

	Organization		
	University	Non-University	Totals
Computer	14	29	43
Manual	17	29	46
TOTALS	31	58	89

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*Data Source: Greenlow, Herron, Rawdon, *Business Simulation in Industrial and University Education*, Prentice-Hall, 1962.

Each one of these characteristics helps to explain why the development of functional management games has centered on production management. In addition the decisions of production management have a direct, immediate, and discernible effect on virtually all other areas of management.

For the marketing function one cannot point out any of the previously stated distinguishing characteristics of production management other than an analogue to the first as far as distribution systems are concerned. Instead one must state the following distinguishing characteristics:

1. Distribution systems are many and varied and to a certain degree complex.
2. The marketing area contains a larger number of decision variables than any other areas of business management.
3. Marketing deals to a great extent with the elements influencing demand and therefore, in economics, sociology, and psychology, it has a well developed theoretical framework on which to build.

As in production the decisions to be made in marketing have a complex interrelationship with the remainder of the firm. These decisions have direct and immediate effects on the other areas of business management and even though their effects are not always quantitatively discernible they are qualitatively apparent.

The combination of a large number of variables and theoretical background undoubtedly influenced the early developers of management games in inserting a relatively well developed marketing area. The early general management games thus served as a starting point for development of marketing games.

The precedent set by early games such as the AMA's and Andlingers was for an abreviated finance function. Andlingers allowed growth only out of retained earnings and when cash balances fell lower than needed for executing plans the player could factor accounts receivable. The AMA game allowed for price changes only within fixed limits and the necessity for staying with the available cash generated from operations.

This precedent combined with the institutional orientation of students, scholars, and practitioners of finance has led to the present state of management games in finance. Despite the fact that functional games in finance are few there have been isolated uses of general management games for financial institutions such as banks and insurance companies.

The area of personnel management has also showed less interest in the development of management games than marketing and production. This follows to a large extent from the subtle and nature of the results from personnel decisions. Except for obvious flaws in choice it is not possible to ascertain direct and immediate effects of personnel decisions. The long history of measurement or the theoretical underpinnings are not available for this area. Therefore the development of management games is slow.

Figures 1 and 2 also show that the development of games has proceeded along both the computerized and manual lines. For obvious reasons the computer based games are by-and-large more complex than the manual both from the point of view of the participant and the calculation of the response of the model. Andlinger's game serves as a model for simplicity of both play and calculation of response. The Harbus 2 model developed by Buchin can be combined with in-basket materials in the "Harbets Simulation Exercise."[7] It represents perhaps the most comprehensive model developed requiring trained personnel to determine certain non-quantitative responses of participants. The number of decisions which can be made is open ended.

2. Uses of Management Games

Figure 2 shows that the development of games has been largely concentrated in non-universities. Although this is an accurate representation is it also fair to say that the majority of the big computerized games have been developed and used in universities as witnessed by the Carnegie Tech Game,[8] Harbus 2,[9] The Texas Game, [10] and the Harvard Business School Simulation.[11] Our interest is, of course, in games used in colleges and universities.

The development and use of large computerized games at academic institutions follows naturally from the fact that class schedules prevent the "one sitting" method of game play. In addition since analysis and synthesis are more important than the ability to make quick decisions it is natural that a more complicated environment should be developed in which more sophisticated tools of analysis could be used.

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[7] Stanley I. Buchin, "Harbets Simulation Exercise," mimeographed, Howard University, January 1963.

[8] Cohen, Cyert, Dill, Kuehn, Miller, VanWormer, Winters, "The Carnegie Tech Management Game," Journal of Business, October 1960, pp. 303-321.

[9] Buchin, op. cit.

[10] A. G. Dale, F. B. May, C. T. Clark, P. J. Lymberopoulos, The Small Business Executive Decision Simulation, Bureau of Business Research, The University of Texas, 1963.

[11] "Harvard Business School Management Simulation," Harvard 1964.

The one game which has received the most notice and been analysed to the greatest extent in the literature is the Carnegie Tech game. It has been thoroughly incorporated into the graduate program at that School. It is, indeed, a complex game with three firms, four geographical marketing territories in which each team maintains a leased finished goods warehouse. Each firm has one factory which will produce all products from seven basic raw materials.

Players must make use of purchased and regularly provided information to make up to 300 decisions in a period. These decisions pertain to purchases of materials, production schedules, shipments, prices, and advertising in addition to financial arrangements. In addition each firm reports to a board of directors justifying actions and outlining future plans.

The level of complexity was designed into the Carnegie Tech game in order to "provide an environment in which players could test and develop some of the positive skill which a manager must employ."[12] The developers felt that simplified games such as the AMA's were appropriate for experienced executives who already possessed specific skills but needed reminding of the interdependent nature of business decision.

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[12] K. J. Cohen, W. R. Dill, A. A. Kuehn, P. R. Winters, The Carnegie Tech Management Game, Irwin 1964

The specific skills which the student was to be given the opportunity to develop were:

1. The ability to set goals and define them operationally.
2. The ability to abstract and use information from a complex environment.
3. The ability to forecast and plan.
4. The ability to combine the role of generalist and specialist.
5. The ability to work effectively with other people.[13]

The entire game operation is designed to help develop these abilities. Because a game experience can become an impersonal affair without specific guards against it, specific "external interactions" are added to the Carnegie Game. Instead of using in-basket materials which the game players can deal with impersonally, live interactions in the form of Boards of Directors, External Auditors, Grievance and Contract Negotiators, and a Stock Market are introduced.[14] Each of these interactions is separate from the quantitative model of the game.

Many of the other games used in university programs have much more limited objectives. For example two general management games (UCLA #2 and UCLA #3) have been used for a variety of reasons including:[15]

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[13] Ibid., p. 9.

[14] Ibid., pp. 77-98.

[15] W. R. Dill, J. R. Jackson, and J. W. Sweeney, Proceedings of the Conference on Business Games, Tulane University 1961, pp. 18-19.

1. To illustrate to freshmen what the job of a manager is like and to attract students to business majors.
2. To break down social and cultural barriers among men from different countries.
3. To show seniors in management science that mathematical and statistical techniques are not sufficient to solve all management problems.
4. To give students experience in making plans and decisions under conditions of high and low time pressure.
5. To teach graduate students how to interpret accounting reports.
6. To allow graduate students in organization theory to observe, analyze, and record the behavior of undergraduates playing the game.
7. To show graduate students the dependence of goal attainment on planning and execution of decisions.

Functional management games also have the same variety of uses that the general management games have had. For instance the M.I.T. marketing game is designed to take the students through the whole cycle of decision making including: (1) problem statement including evaluation of information; (2) analyzing the problem; (3) making knowledge and assumptions explicit; (4) evaluation of alternatives; (5) choosing between alternatives; (6) implementation; (7) monitoring the environment to determine success; (8) review.[16]

On the other hand many games are developed to illustrate specific characteristics of particular functions. The following two examples illustrate these types of game uses. Monopologs, a game developed by the Rand Corporation is used by the Air Force to introduce people to the supply system.[17] Wayne State University has developed a game which is used to demonstrate the intricacies of the automobile market for new and used cars as well as parts.[18]

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[16] A. E. Amstutz and H. J. Claycamp, "The Total Market Environment Simulation," Industrial Management Review, Spring 1964, pp. 47-60.

3. The Evaluation of Management Games

Although there are many games in existence there is relatively little in the way of evaluation of games. Much of the material written on evaluation consists of qualitative statements such as those which follow pertaining to the type of behavior witnessed over the course of game play.[19]

1. "They do become quicker and more sophisticated about abstracting, organizing, and using information from complex and diffuse environment. They recognize better the differences between valuable and trivial information."
2. "...their plans are based on more rational assumptions...they learn how economic concepts like marginal analysis or return on investment apply to specific management decisions."

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[17] Renshaw, J. R., and A. Heuston, The Game Monopologs, The RAND Corporation, RM-1917-1, 1960.

[18] Greenlaw, et al., op. cit., p. 339

[19] Cohen, et al., The Carnegie Tech Game, Irwin 1964, pp. 253-254.

3. "Over the course of a semester, are usually noticed improvements in the level of preparation for meetings, in the skill with which ideas are presented, in the tenacity with which ideas are defended, and in the subtlety with which teams control the agenda of meeting and the direction which discussion takes."
4. "...students become more sensitive to the factors involved in establishing and maintaining effective working relationships with their teammates...."

Beside these general qualitative statements on what students learn from the game experience the Carnegie researchers have coded student responses to the question of what they learned. They found

"... almost two-thirds of the statements about what was learned simply reflected new recognition that certain problems exist for managers. This is an important kind of learning, to be sure, because many of managements' failures are failures to recognize or acknowledge problems. But it can still be regarded as a lower level of learning in a specific or general way how to deal with a problem. Only three per cent of the statements were explicit, specific descriptions of the solutions or strategies that had been learned."[20]

Looking at the student responses to the question of what they had learned from another viewpoint it was found that 69% of the responses could be attributed to the players experience as participating in small groups or his experience with outside groups. No responses could be attributed solely to the computer model.[21]

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[20] W. R. Dill and N. Doppelt, "The Acquisition of Experience in a Complex Management Game," Management Science, October 1963, pp. 30-46.

[21] Ibid., p. 38

The Carnegie Tech Game is seen as an environment for self-instruction rather than an environment for teaching. The experience gained from game play is much the same as experience gained from real life. Because of the complexity of the learning process in such an environment and because of the difficulties of running adequately controlled experiments Dill and Doppelt doubt that effects of management games can be determined by comparative studies.[22]

McKenney[23] and Robinson[24] in earlier work had a different opinion. McKenney sought to evaluate a game used as an adjunct to a graduate level course in production management at Harvard. Robinson indicated both the types of experiments to be performed and the measures to determine the effects.

McKenney divided the production course into two groups, one of which played the UCLA Executive game #3 while the other studied cases. Each group was given both pre-game and post-game tests consisting of cases relating three concepts:

1. "Today's decisions create tomorrow's environment."
2. "Goals and plans are carried out by a series of consistent decisions that vary in accordance with the environment."
3. "Functional decisions of a firm are interrelated."

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[22] Ibid., p. 45

[23] J. R. McKenney, "An Evaluation of Business Games as a Learning Experience," Journal of Business, July 1962, pp. 278-286.

[24] J. A. Robinson, "A Research Design for Comparing Simulation with Case Studies and Problem Papers in Teaching," in Dell, et al, ed., Proceedings of the Conference on Business Games, Tulane 1961.

Each of the examinations was graded by an experienced case grader using a separate seven-point scale for each of the defined concepts. Precautions were taken to assure consistency in grading as well as to avoid identification of examinations.

Following a detailed statistical analysis McKenney was able to draw the following conclusions:

a. Gaming can teach planning to decision-makers. A trade off of case time for game time can be beneficial if planning is one of the teaching objectives.

b. Game players were more aware of the interrelationships of functions within the firm than were non-players.

c. There was no discernible difference between the players' and non-players' awareness of the effect of today's decisions on tomorrow's environment.

In addition to true statistical analysis McKenney observed the effect of varying some administrative factors. In organizing teams he used different numbers of players in order to evaluate the effect of team size. Rather than let all firms compete in a single industry he introduced multiple industries. In addition the length of time between submission of decisions was varied in order to ascertain its effect.

Using a qualitative analysis he was able to determine that multiple industries provided a great deal of benefit in letting the students follow the course of all industries. In this way students could clearly see how the individual decision makers controlled their environment. The most appropriate size of firm was determined to be five on the grounds that smaller firms required "too much" work and larger groups "not enough." One week between decisions was determined to be best.

Robinson did not report the results of a study but rather the design of experiments to test the following claims:

1. "...gaming makes participants more explicit about what... they are doing, seeing and hearing."
2. "...simulation provides results of participants' decisions within a short period after they are made, thus giving the student evidence of the quality of his decisions. This validating or non-validating mechanism is not ordinarily present in case studies or problem papers, and appears to have some of the effects of teaching machine."
3. "...gaming...methods heighten student interest and motivation, thus enhancing learning."
4. gaming provides learning..."which is general and structural and not bound by specialized content or issues."
5. gaming provides learning "...which integrates materials relating the processes by which decisions are reached as well as the substantive issues involved in the decision."
6. gaming provides learning "...which masters factual material provided in texts, lectures and discussions."

Robinson classifies the first three effects as intermediate leading to the last three which are ultimate effects. Robinson goes on as follows: "In addition to investigating whether these effects occur, we would study the conditions under which they are found, if they are found. The conditions which we specify are the individual characteristics which students bring to their training.[25]

Measurement of the effects was to take place by certain parts of the final examination, questionnaires and interviews.

Judging from the published material, the educational valuation of management games has not been completed. Before we explain the results of our experimental research, we will describe the results of a survey questionnaire and telephone interview study of the present state of management gaming.

D. Survey Questionnaire and Telephone Interview

Among the many articles that have been written on business games, there is little information on either the purposes for using games or the methods of administration of these games. A considerable void exists in research on gaming as a teaching method. Therefore, a summary of the collective experiences of teachers using games might be useful, especially to those considering new or altered business courses.

A survey was planned and conducted to develop information on the extent and method of computerized game usage. This included the problems associated with game development and administration.

The survey consisted of two parts; first, a mailing sent to the Deans of collegiate schools of business, and second, a series of telephone interviews with selected users of computerized business games.

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[25] Robinson, op. cit., p. 126.

The objectives of the mail survey were:

1. To provide a list of those teachers most involved in gaming to use as a basis for selecting telephone interviewees.
2. To determine the extent to which schools have the computer capacity to handle various sized games.
3. To determine the reasons for discontinuing games, in instances where they had formerly been used, but dropped.
4. To develop as complete a list as possible of all those conducting research on computerized business gaming.

The objectives of the telephone interviews were:

1. To determine teacher expectations of student learning in the gaming environment.
2. To ascertain techniques of administration used for the gaming environment.
3. To learn of problems which arise during use of the games and also, to determine what teachers feel are the causes of these problems.
4. To trace the adoption process of those games which are used by other than the original developer.

5. To determine the problems encountered in adopting a game developed by another source.

Procedure

A two-page form was sent to the Deans of 165 business schools with the primary purpose of determining those faculty members using games. The names and addresses were obtained by using all Schools or Colleges of Business or Commerce listed in the 1964-65 Edition of The World of Learning.[26] These included the 113 members of the American Association of Collegiate Schools of Business.

Within five weeks more than 80% of the schools had responded. At that time, a follow-up letter and questionnaire were sent to non-respondents. The final total of responses was 158 out of 165, or 95%. A copy of the questionnaire is included as Appendix A.

From these responses, the schools which seemed to have the most extensive use of games were selected. The sample was chosen so that it would include both the schools where extensive game development had been accomplished and schools that had used games but had not spent an extensive amount of time on development.

It was intended that the telephone interviews be open ended in that they would cover the respondent's reasons for using games, experiences with developing and administering games and level of commitment to games as a teaching method. An outline of questions was developed that would guide the interview. It was expected, however, that the discussion would be carried on in a fairly free manner and the questions would serve merely as a guide.

Each faculty member of whom the interview was being requested was encouraged to give thought to the telephone discussion before it actually took place. This was accomplished by sending a letter containing four questions, beforehand, to the interviewee. These questions were those which required quantitative data or rankings and thus would probably be more effectively answered if the respondent allowed some time for development of the answers. Thirty requests for interviews were initiated; 24 interviews resulted. Copies of the questions mailed to selected respondents and the questions used for telephone interviews are presented as Appendix B and Appendix C.

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[26] The World of Learning, 15 ed. (London: Europa Publications Ltd.) December, 1964.

Although the mail questionnaire was used for the primary purpose of determining the computerized business games being used by collegiate schools of business, it was also designed to provide several additional items of information. It was hoped that these additional items would be helpful as a composite when analyzing game usage. The first of these purposes was to determine the availability of computers for teaching purposes and to compare this with game use. Secondly, in a survey of this type, the researcher could expect more responses from those who were using games than from those who were not, strictly because of interest level. Thus a series of questions which included checklists of reasons for not using computerized games or for having used and then discontinued a game, was provided. It was felt that this might give some additional information on the problems of game use. As part of this grouping, a question on hand computed business games was included so that their usage could be compared with computerized game usage. Questions 2-4 (Appendix II-1) cover this point.

Since it was the overall purpose of this project to evaluate business games as an educational technique, it was useful to learn of other research being conducted which had not yet been published.

Questions 5 and 6 (Appendix II-1) were designed to gain as complete a list as possible of schools which might be doing or had completed evaluative research on games. Question 5 was designed to indicate research at the school receiving the questionnaire, while Question 6 requested names of researchers known to be working at other schools. This was intended to reveal research activities at schools not responding to the questionnaire or schools which had not been included in the mailing. A list of schools where research was indicated is given as Appendix II-4. It is interesting to note that in many cases an individual or school did not purport to be doing research (answers to Question 5) while responses from other schools on Question 6 would indicate knowledge of such research, i.e., School B would list School A as doing such research while School A would not list itself. Such situations were not included in the listing of Appendix II-4.

Questions 7 and 8 (Appendix II-2) were intended primarily to serve as bases for selection of telephone interviewees. They did, however, also give some indication of the games in common usage and a rough comparison of available computer capacity versus game requirements. The intention of Question 8 was also to provide an indication of the number of students to whom games were available, but this did not prove to be very useful on a composite basis.

Figure 1 indicates the results of the question on computers available to faculty for teaching purposes. Since 85% of the machines listed were manufactured by the IBM Corporation, the current IBM model categories were used. Other models were then matched to the IBM categories by matching equivalent memory capacity as closely as could be determined. Obviously, there are many problems with this method of categorizing because actual installations, even of the same model, vary considerably in capacity due to different peripheral equipment. However, when compared with the approximate requirements of various business games, indications of the range of possible business games do become apparent.

Figure 1

Computers Available to Faculty Members for Teaching Purposes

Machine Size	Number Reporting Machine		
	AACSB Members	Nonmembers	Total
IBM 7090	23	1	24
IBM 7070	7	1	8
IBM 7040	14	1	15
IBM 1410	5	4	9
IBM 1620	36	24	60
IBM 1401	8	3	11
Smaller than 1401	1	3	4
Machine Size not indicated	14	3	17
Indicated no Machine	1	9	10
Total	109	49	158

In developing Figure 1, responses from members of the American Association of Collegiate Schools of Business were separated from nonmembers because of the expected difference in resources of the nonmember schools. Also, in those cases where access to more than one machine was indicated by a school, the machine with the largest memory capacity was used in the tabulation.

As a means of comparison, it was useful to consider the computer capacity requirements of a few of the well known general business games. When examining games commonly used by business schools (answers to

Question 7), as well as game manuals, capacity requirements appear to break down into two distinct categories. The first group, the large simulations, would include the Carnegie Tech Management Game, Harvard Business Simulation, MIT Marketing Simulation, University of Chicago's INTOP and, as the smallest in the group, UCLA Game #3. All of these were written for 7090 size machines. There is the possibility that these could be modified to work on 7070 size. In the case of the UCLA Game #3, there is a chance it could be made to work on the 7040 size.

The other grouping of games commonly used would be the small to medium-sized game, examples of which would be the IBM Management Decision Laboratory - Model 1, UCLA # 2 and the Boston College Game. In reality, these three games, or modifications of them, are the simulations most commonly used by respondents to the questionnaire. They usually are single-product games requiring about ten decisions by the student per period of operation.

These smaller games were often developed for specific machines of the 1620 or 1410 type, but in many cases, programs have been modified enough to work on more than one machine. For example, the IBM Game has been rewritten so that it will work on some 1401's, a machine for which few games seem to exist.

It might be well to point out at this time that the IBM 1620 is a much less expensive and slower machine than most IBM 1401 units, even though it is usually equipped with more memory capacity. Since memory size often is the limiting factor on a game, the 1620 machines, which many institutions have because of their usefulness as research calculators, allow game play even at a slow machine speed.

Results indicate that 20% of responding schools have 7090 size machines. If the schools with 7070 size machines are included with those who have machine capacity to handle the large games, this means that given today's available games, 75% of the schools do not have the machine capacity required for these large games. There is some evidence of games currently being expanded from the 1620 size to make use of 7040 capabilities but there seems to remain a large size difference between the two groups of games.

The category of 1620 size machines is the largest group available to faculty, and more than half of the schools have this as a size limiting factor. This might well indicate why most of the schools which indicate game development activity have been working to adapt games to the 1620 and use that machine's capacity most effectively.

The distinction between responses of member versus nonmember schools of the AACSB shows even more clearly that computer capacity often determines gaming alternatives. With only one machine listed in each of the three large machine categories, it must be assumed that most schools are restricted to rather small games. Many of these schools do have access to large time-shared computers at centers such as the New England Universities group at MIT and Western Data Processing Center at UCLA. However, terminal speed restrictions and mailing processes often cause additional problems. For example, a number of western schools have used the UCLA Game # 3 at the Western Data Processing Center, but most have discontinued this practice. Because of two-way mailing times or in the cases of schools with small remote terminals, mail delivery of printed output, the total cycle between decisions required two weeks. It seems that many teachers felt this was not a feasible or practical way to use the simulation.

Figure 2

Summary of Responses to Questions 2-4 (Appendix II-1)

	Total	AACSB Members	Nonmembers
Used Computer Games 1964-65	70	79%	46%
Had Changed Computer Games for 1964-65	30	34%	18%
Had Used Previously, But dropped Computer Games for 1964-65	11	11%	10%
Used Hand Computed Games in 1964-65	45	48%	30%

Note: Percentages on the first three lines use number of schools reporting access to a computer as the bases while percentages on the fourth line are based on the total number of responses to that question.

Figure 2 presents a summary of the answers to Questions 2-4 on Appendix A. Seventy percent of all those indicating access to computers indicated that computerized games were being used during the current year. This percentage is considerably higher for AACSB members than for nonmembers. Responses to Question 3 were broken down into those schools which had discontinued at least one computerized game but were still using one or more games and those schools which had used but dropped a game and were not currently using any. This was done so that the reasons given for no longer using the game could be compared for these two groups.

One notes from Figure 2 that, of schools not at present using games, even though they had access to computers, half of them have at one time used such a game. A reason given by the majority of these respondents for dropping the game was that the faculty member who utilized the game moved on to other employment. Each of the other possible answers received only scattered response.

The major reason given for changing one or more games, as would be expected, was substitution of a more appropriate game. Discounting this response, the major responses were "d" and "e," consumption of too much student and faculty time. Another common response was game change due to machine change.

It is interesting to note that the use of noncomputer games is less prevalent than computer games. The major reason given for not using these games was written in under "g-other reasons." The notations indicated, in general, that computer games removed the excessive computation time required of both students and administrators when using a hand-computed game. This write-in response must be considered to be a prevalent opinion because it was the only one to receive a significant number of indications.

Telephone Interviews

Telephone interviewees were selected to include those faculty members who had been most active in both developing and also in using games. The authors of literature on gaming were considered as well as the information from the mail questionnaire. The attempt was to select a group, all of which would have had considerable experience with games, about half of the group as developers and users and the other half of the group as users only.

The results of the telephone interviews will be presented mainly as descriptive interpretation by the interviewer, especially since very little quantitative information became available.

The telephone interviews were designed to develop information on a number of interrelated topics. The interviewer's interpretations of these conversations will be presented under several headings. They are: (1) the purposes of game usage and the areas where game users seem to feel games are most useful; (2) student reactions to the game environment, as stated and interpreted by game users; (3) methods or techniques of administration and problems encountered in administration; (4) an attempt to trace game development and usage, processes of game adoption, and ensuing problems of development and adoption.

Purposes of Game Usage

To determine the purposes of game usage, questions were asked concerning the courses in which games were utilized and the purposes of both the course and the game. Also, one of the questions included in the mailing to the respondent before the interview and then discussed over the telephone (See Appendix B) requested an indication, for each of six different types of subject matter, of that portion of class time to be used for each of five teaching methods.

This is admittedly a summation of very subjective opinion but there are several results which seem to be directionally significant. First, almost all of those responding to this question indicated, that in a course to teach factual subject matter, they would not give any time to a game. This is interesting when compared with the fact that almost half of these same respondents would give some time to business cases.

The two subject matter areas where the strongest and most uniform proposed use of business games was indicated were "Integration of Concept" and "Decision Making." Seventy-five percent of respondents to this question indicated they would use between 25 and 50% of the class time in these subject areas for business games. This indicates the concept, often expressed in the interviews, that games be used in addition to rather than in place of other teaching methods. A business game was felt to provide a reasonable core or structure to which material presented by other teaching methods might effectively be correlated.

Approximately 40% of the respondents gave identical answers for the design of classes for "integration of concept" and "organizational design." The interviewer further questioned several who responded with these identical answers to determine if they felt the two subject areas were the same or similar. These respondents indicated that the areas were, to them, quite different. Further discussion, however, indicated that "integration" often meant a type of "interaction between the activities of the functional areas of a company." "Decision Making" likewise seemed to mean decision making at the top level. Since top-level decision making implies that all functional areas need to be considered, the two subject areas do seem to merge into a composite purpose.

These responses were pointed out because when respondents were asked in which courses they used games and what the purpose of games in these courses was, most indicated either business policy or marketing management, focusing on integration of the marketing function with other aspects of the business environment. The indicated purpose of the game was usually to provide an atmosphere in which students could experience decision-making. The environment was intended as one that would require integration of previously learned material. The interesting aspect was that the interviewer often received the impression that the emphasis of the game was on functional integration while the stated intent of the course was policy or strategy formulation. Although this is not in any way conclusive, it may indicate the emphasis that these game users feel is most useful. Often business cases seem to have been used to provide the policy emphasis.

Indicated course designs for the subject areas of organization design and motivation toward business were not as uniform as they were for the three previously discussed subject areas. Organization studies and motivation have, in the literature on business games, been held to be useful situations for business simulations. Part of this variance might be attributed to the lack of interest in these subject areas by the respondent group. Most of the respondents appeared, from their discussions, to be more interested in integrative courses. However, several who were interested in organization design indicated that less complex hand games were better for research and teaching of organization design than the more complicated computer games.

The respondents were asked to design a course in "motivation toward business." This was done to determine the usefulness of games for the type of course often used early in general college curricula to introduce business concepts to new students with the hope of motivating some students to enter the business school. Although a number of schools have such course, only one of the respondents indicated use of a computer game in this course. Responses of how game users would design courses in this area indicated that about one-half of the teachers would combine lecture and games. This would seem to indicate that business games are not extensively used for introducing students to business study even though there are those who feel they would be useful in this area. Possible reasons for this might be the administrative problems of using games for large numbers of students plus the mere fact that teachers personally interested in simulation may not be teaching these courses.

It is worthy to note, also, that in discussions of the purpose of games in the business curriculum, the emphases of the respondents were usually on "providing an environment in which the student might learn" as opposed to "a method of teaching." The nature of gaming and the way in which games are used imply that the source of learning is the student and his surroundings rather than the teacher, thus making the created environment critical.

The basic reasons given for using games were, as indicated, integration of business functions and decision-making. Other stated purposes, the majority of which interact with the major purposes, were: (1) to have students learn the process of problem isolation and the development of solutions; (2) gaining experience in the monitoring of an environment; (3) to allow the student to make more explicit his own decision-making process; and (4) to consider the effects of group action.

Several of the respondents who were more interested in model building as a quantitative technique used games for a very different purpose.

They were involved with courses in quantitative methods and had students play the games for several periods. They would then give the students the computer program, asking them to determine how the model worked and what assumptions the model implied.

Student Reactions to the Game Environment

This summary of the manner in which game users see students reacting to game situations was compiled from general discussion and from responses to the critical incident questions mailed to the respondents before the interview.

The degree to which students are motivated by gaming ranged from the reaction "no greater motivation than other methods" to indications of such high motivation that other class activities and other courses were seriously neglected. The level of motivation was indicated by most respondents to be rather uneven and influenced significantly by such factors as the complexity of the game, the importance of the game to the course grade, the portion of the semester that had passed and the degree of integration of the game with the remainder of the course and curriculum.

Complexity seemed to effect motivation in several ways. There were indications that the less complex games often motived the student to look for "gimmicks" in the model rather than acting as a manager. This was especially true if there was available on the student "grapevine," information about the game from previous courses. Thus the carryover of information from one semester to the next did seem to have an effect on results, especially with the less complex games.

The portion of the course grade based on game play was most often stated as between 0 and 25%, with a number of users giving no credit at all and several who used complex games allowing considerably more than 25%. A majority of the users did expect a greater portion of the student's time to be spent on the game than the stated percentage of the total course grade assigned to game activities.

There was significant disagreement on how the amount of credit given for the game affected student game activity. Those who used the game with no credit given specifically for game activities seemed to feel that students still were motivated to apply sufficient effort. Conversely, most users felt the students had to see the game as important to their grade and as being a focus of the course. Otherwise, it was indicated, the administrator could expect "spotty" motivation and much decision making without analysis.

Actual game grades were usually based on such devices as planning papers, decision logs, and peer rankings by team members rather than on game results. There was considerable question of how well the grading process measured whether game effort or learning. Thus, the difficulties of grading a game may affect the extent of its usage.

Since most of the respondents indicated that games were used throughout the semester, usually with one period's play per week, one might question the possibility of changes in effort and motivation throughout the semester. There were indications, especially with the less complex games, that most of the effort occurred at the beginning of the operation, with much of that effort going toward understanding the environment. Then, during the period when the student is expected to monitor the environment and develop the decision making tools, less effort is expended. This was related by several of the respondents to the buildup of work requirements on the student by all of his courses as the semester progresses.

A large majority of the respondents indicated that they operated by allowing the game teams to develop their own organization, usually allowing the teams to form their own membership. Also, they did not include specific means of analysing the game data in the class discussion, but expected the team to develop their own methods. There were several differences with this concept from administrators who felt specific means of analyszing game data should be given and that this would result in better motivation and learning.

One of the focal points of discussion during the interviews was the degree to which teachers were able to determine areas of weakness in a student's understanding of business subjects during the course of the game. Several of the game administrators who used relatively small teams and the less complex games indicated that they could spot weaknesses fairly effectively. However, those with larger teams and more complex games indicated that this feedback to the teacher did not occur, except possibly in the final written reports at the end of the game. There were several comments to the effect that students might understand these weaknesses themselves and that games might encourage the students to attempt to improve in those areas where they already realized they were weak.

The organization of teams for the more complex games may affect the feedback of these weaknesses. There are indications that student teams recognize weaknesses and strengths among peers, and for games complex enough to require effective division of labor, assign team members to functional labor according to their strengths. This could affect feedback to the teacher on individuals and also could in a way, negate the intended game purpose of giving an integrated, policy level understanding of business.

Methods of Administration

The form of game administration used by respondents varied considerably. Most used the games on the basis of one play per week throughout the course period, often allowing the first period to be a trial run. Organization descriptions and planning papers were required throughout the semester with some games requiring reports during the course of play to a board of directors composed of faculty. Most games also required a final session of reporting decisions and results to the class.

Actual operation of the simulation was often handled by either a data processing department or graduate assistants. One of the problems consistently indicated was turnover of these people. Usually by the time they had become familiar with the operation, they would move on to other employment.

There are indications that operation of a computer game requires careful planning to overcome computer schedule problems. Invariably, there are mistakes in data inputs, and thus schedules can be drastically affected if a two-day turnaround is required beween data input and output from the computer. This was an indicated reason for using a small simulation by several schools which had machine capacity for large games. They were able to run the small game on a smaller machine on which they could obtain better priorities. Many respondents did feel that computer caused delays of the game did significantly affect player motivation.

Another indicated administrative problem was the logistics of collection of input sheets and distribution of output. Often the class meetings were not convenient times to do this and a number of respondents indicated that this problem should be considered in designing the operation.

One of the methods often stated for improving the environment of the game operation was use of boards of directors or other faculty groups to which the teams would report their activities. The primary administrative problem involved with this seems to be the obtaining of faculty members outside the course who will serve. Most of the very large games are used in such a way as to require a considerable number of these people. There are indications that users of some of these gaming situations are redesigning their operations partly because of the difficulty of maintaining the interest of these faculty members not usually involved with the course using the game. Users of the smaller games which required faulty boards usually stated that they used only faculty of the course for this purpose.

In general, respondents to the interviews did feel that the administrative process had to be well understood in order to expect a well accepted game operation. There were strong indications that learning to administer a game is a very time consuming process. A particular indicated problem was learning what effects parameter changes have on the environment. Although most respondents claimed that parameters should not be changed over the period of the game, the administrator often wanted to make changes to give the environment aspects which they felt were important. It was indicated that, for significant changes, many trial operations were required in order to achieve a well balanced result.

This section can best be summarized by indicating that the most significant negative response about gaming was that it takes far too much faculty time. A common estimate of this was that a course using a computerized game requires twice as much faculty time as a course of equivalent units without a game.

Game Development and Adoption

There are indications that a major consideration in the level of emphasis that a school places on gaming is the availability of a faculty member interested in developing the game and the administration process. The procedure followed in obtaining a game is usually contact with the developer. There seems to have been very free flow of information regarding games between users. Most current games seem to have been developed by first adopting a game and then making adjustments to provide a more desired environment. The majority of these individual adoption efforts seems to have been applied to improving the smaller games and making them work effectively on the smaller computers. However, a large block of effort has been expended into the four large games developed at Carnegie Tech, Harvard Business School, Massachusetts Institute of Technology, and the University of Chicago. These simulations seem to have been developed largely independent of each other. Although there have been uses of these large games at other schools, there are indications that they were generally not successful, usually due to problems of transferring between computers. There are, however, indications that some of these machine compatibility problems have been solved and that during the 1965-66 school year several other schools will use these large simulations.

The most distressing problems of adopting a game, according to a number of respondents, were the program "bugs"that existed in the programs as they were received. These often were not due to program errors at the sending school but rather differences in computer operations at different schools. Also, misunderstandings of operating instructions often caused problems. Respondents indicated that they expected the problem of game transfer to diminish as computers used more "universal" languages. Also, as more of these games are published, they will probably be written to reduce transfer problems.

Conclusions

Response to this survey indicates that there is widespread use of business games in collegiate schools of business and that those who are using games are searching for the most effective ways of building them into their curricula. Game usage does seem to be restricted by computer availability, faculty time resources, and ability to transfer games between machines. The method of game administration and the means by which the game is integrated into both course and curriculum were considered by respondents to be of major interest. In fact, a summary impression of the current activities in game development is that far more effort is being expended on development of the administration processes than on game models and programming.

Computer games seem to be used mainly for capstone type courses in business curricula. The emphasis seems to be on using the game as a core or trunk to which material handled by other methods could be tied. This might imply that the game should be used earlier in the total curriculum, or throughout the curriculum, rather than just for the last course, but, with only a few exceptions integrative games do not seem to be used in that manner.

Again it must be emphasized that the substance of this report is drawn from subjective interviews with game users who would be expected to be biased toward these games as teaching devices. However, the summary of their opinions and experiences does seem to point out a number of aspects of computer game use which could fruitfully be studied further.

E. The Experiments of the Project

The basic approach to the research project was based on the following tentative hypotheses:

H1: The management game serves as a motivating device. Students who participate in a management game are more highly motivated in their study than those who do not play.

H2: The management game contributes significantly in the transmission of facts and the understanding of concepts. Students who play a management game gain a greater knowledge of facts and a better understanding of concepts than those who do not play.

H3: The management game contributes significantly in the integration of facts and concepts studied in separate situations. Students who play a management game have a better understanding of the interplay of facts and concepts from various functional areas than those who do not play.

H4: The management game, by providing an opportunity for simulated business experience, leads to an improvement of the quality of decisions. Students with decision experience in a management game will be better decision makers in a "real life" situation than those who do not have management game experience.

H5: The management game experience of a student can significantly change his attitude toward management, business and business education. Students who experience game play have more favorable attitudes toward managment, business and business education than those who do not.

The major contributing variables relating to these hypothses are:

(1) Game construction.

Business games vary in construction from those which can be analyzed by a single participant and the feedback calculated by hand in a few moments to those that take days to analyze and considerable computer time to calculate. This spectrum will be divided into two parts. The first part will consist of all games which require fewer than 12 decisions. These will be called simple games. The second part will be called complex games and will represent those games with more than 12 decisions for each simulated time period.

(2) The number of players constituting a firm.

Business games are played with a wide variety of players in a firm. We shall be interested in just two cases. One where a single player constitutes a firm and one where each firm consists of more than one player and hence there is group interaction.

(3) The level of application.

Business games are played at a number of different levels from beginning students in general courses to specialized courses to advanced courses. We will be concerned with two categories; they are graduate students and undergraduate students.

In the experiments which follow we have used two games. The simple game was developed by Professor Thompson. The Harvard Business School simulation was the complex game. These two games were used in undergraduate and graduate courses primarily to study hypotheses H2, H3, and H5.

Appendix II-1

BUSINESS GAMING IN COLLEGIATE SCHOOLS OF BUSINESS

1. Do faculty members have access to computers for teaching purposes?

   Yes_____ ↓ No_____ (IF NO IS CHECKED GO TO QUESTION 4)

   Please indicate the models of computer.______________________

2. Are one or more computerized business games being used during the current academic year in the college's curriculum?

   Yes_____ No_____ ↓ (IF YES IS CHECKED GO TO QUESTION 3)

   Please circle below the letter of any statement or statements which you consider to be major reasons for your not using computerized business games.
   - a. Adequate computer facilities are not available.
   - b. Adequate funds are not available.
   - c. We have found hand-computed business games to be adequate for our needs.
   - d. We feel appropriate games are not available.
   - e. Faculty with computer experience to administer the games are not available.
   - f. We feel that games have as yet not been proven effective for teaching.
   - g. We are planning to use a computerized game in the near future.
   - h. Our evaluations of games for teaching purposes are still in progress.
   - i. We have not considered computerized games for teaching.
   - j. Other reasons (please specify).

3. Are there any computerized business games which have been used in your college's curriculum in previous years but which are not being used this year?

   Yes_____ ↓ No_____ (IF NO IS CHECKED GO TO QUESTION 4)

   Please circle below the letter of any statement or statements which you consider to be major reasons for your not using these games now.
   - a. A more appropriate game has been substituted.
   - b. The course using the game was not offered this year.
   - c. The game was found to be ineffective for teaching.
   - d. The game consumed too much student time.
   - e. The game consumed too much faculty time.
   - f. Game operation expenses were too high.
   - g. Faculty members who used the game have moved to other employment.
   - h. The game was not intended to be permanent.
   - i. Other reasons (please specify).

Since we are very interested in studying the problems of game use as well as the benefits, it would be most helpful if we could contact those faculty members who have been involved with computerized games which are no longer being used. Thus, we would appreciate your listing below the names of the games formerly used and the names of the faculty members who used the games.

____

____

____

4. Are one or more hand-computed business games being used during the current academic year in the college's curriculum?

Yes______ No______ (IF YES IS CHECKED GO TO QUESTION 5)

Please circle below the letter of any statement or statements which you consider to be major reasons for your not using these games.

a. We feel that appropriate games are not yet available.
b. We feel that games have as yet not been proven effective for teaching.
c. Lack of qualified faculty members has prevented use of games.
d. We are planning to use games for teaching in the near future.
e. We have not considered games for teaching.
f. Our experiments have shown that games are not effective for teaching.
g. Other reasons (please specify).

5. If there has been any specific research directed at validation of business games as an educational technique at your school, would you please give the name of the researcher. ____________________

6. If you know of evaluative research on games at another school, would you give the name of the school and the researcher, if known. ____________________

7. Would you please give the names of those faculty members who are active in using business games, listing those who have been most active first. We will contact most of these people, many by telephone, to discuss their experiences with these games. An indication, if known, of the names of the games used by each would be helpful.

____

____

____

____

8. Would you estimate the present enrollment of business students in each of the categories tabled below, including pre-business students who are not as yet enrolled in the business school.

	1st & 2nd Yr. Undergraduate	3rd & 4th Yr. Undergraduate	1 Yr.Masters Program	2 Yr.Masters Program	Doctoral Program
Full Time Students					
Part Time Students					

9. Form completed by____________________Title__________________

School____

Thank you! Please place the completed form in the enclosed reply envelope to:

Mr. Paul A. Gruendemann
School of Business
University of Wisconsin
Madison, Wisconsin 53706

Appendix II-2

QUESTIONS FOR AN INTERVIEW ON COMPUTERIZED BUSINESS GAMING

1. For each business school course using a computerized game with which you have been involved, would you divide the total course time expected of the student into the following four categories: (1) Game introduction and orientation, (2) Actual play of the game including activities or assignments designed specifically to integrate the game with the course or curriculum requirements, (3) Discussion of results after completing play and (4) Other course material not directly related to the game. Please make this breakdown for both scheduled classroom time and for the study time expected of the student outside class.

	(1)		(2)		(3)		(4)	
Course Number	Introduction		Play		Discussion		Other Material	
	Class	Outside	Class	Outside	Class	Outside	Class	Outside

2. Would you describe a situation in your experience where you felt the results of a gaming situation were particularly valuable to the student, or where you felt the results were particularly poor.

3. Would you indicate what you feel to be the biggest problems of using games in the manner in which you have used them.

4. Listed below are a series of subject areas and five distinct teaching methods often utilized by business schools. Please assume that you are designing a class for each subject area, in each case assuming you are only interested in that one area. Realizing that these teaching methods are often used in conjunction with one another, would you indicate the percentage of class time of each of the teaching methods you would use in a course designed to cover each subject area.

Subject Area	Lecture	Discussion	Role Playing	Business Cases	Business Games
Factual Subject Matter					
Conceptual Subject Matter					
Integration of Concept					
Decision Making					
Organization Design					
Motivation Toward Business					

Appendix II-3

Question Format for Telephone Interview

The questions used as the format for the telephone interviews were divided into four separate groups. These groups were:

1. On games developed by the respondent
2. On games used but not developed by the respondent
3. On each course in which the respondent used a game
4. On the administration process of each game used

Games Developed by Respondent

1. What is the name of the game?
2. What machines have computer programs been written for?
3. What decisions are required of the participants?
4. What is the approximate game running time?
5. Were there any background games on which this one was based?
6. How much time was used in development of the game?
7. How much machine time was used in development?
8. What other schools are using the game?
9. What were your major reasons for developing the game?
10. What were the major problems of development?
11. Has the game changed because of student reaction?
12. Are changes proposed in the near future?
13. What level of computer knowledge is needed to administer the game?

Games Not Developed by the Respondent

1. What is the name of the game?
2. What machine do you use for the game?
3. What decisions are required of the participants?
4. What is the approximate game running time?
5. Why was this particular game selected?
6. What process did you follow to obtain the game?
7. What programming problems were involved in preparing to use the game?
8. How much time did this take?
9. How much time did it take to learn to administer the game?
10. How well was the game documented?
11. How easy would it be for you to make changes in the program?
12. Do you expect to make changes in the game?
13. What level of computer knowledge is needed to administer the game?

Course

1. What is the name of the course?
2. What is the course number?
3. Of whom is the course required?
4. What other students take the course?
5. How many students used the game last year?
6. How often is the course offered?
7. Is the game considered to be a permanent part of the course?
8. Is the faculty of the course relatively stable?
9. When is the game played during the period of the course?
10. How many periods are run?

11. How many members are there per team?

12. Do you attempt to specify team organization?

13. Just what is the student expected to learn from the course?

14. What is the purpose of the game in relationship to the course?

15. Is student reaction and motivation uniform?

16. Just how are the students graded on game play?

17. What part of the student's grade is based on the game?

18. What assignments are used to integrate the game with the course?

19. How specifically is the actual procedure of making quantitative evaluations in the game spelled out to the student?

20. Is there a significant feedback to the professor indicating those areas where the student is weak?

Administration

1. Who actually administers the game?

2. How much time does this take?

3. Are meetings held with the faculty to integrate the game with other courses?

4. Do computer scheduling problems occur?

5. Do computer delays affect player morale?

6. Is the carryover of information from one semester's students to the next on how to play the game a problem?

7. Are parameters changed during the course of play?

8. For someone wanting to have a business game, would you suggest designing one of your own or adopting that of someone else?

9. To what extent, in general, do you feel games are maintained to provide a vehicle for research activities?

Appendix II-4

Schools Involved in Evaluative Research in Games

The survey indicated that the following schools were involved in evaluative research on gaming:

Boston College
Carnegie Institute of Technology
University of Chicago
University of Colorado
Florida State University
Harvard Business School
University of Houston
University of Illinois
University of Maryland
Massachusetts Institute of Technology
University of Miami, Florida
University of Minnesota
New York University
University of North Carolina
Ohio University
University of Oregon
Purdue University
University of Pennsylvania
San Diego State University
Texas Technological College
Texas Christian University
Washington and Lee University
Wayne State University
University of Wisconsin
Yale University

CHAPTER III

MANAGEMENT GAMES AND STUDENT ATTITUDES

by

A. C. Johnson and D. Lamers

A. Concern with Nature of Attitudes; Their Relationship to Knowledge

Any study of images of and attitudes toward business is necessarily compounded by the vagueness of the concept of attitudes or images and their multi-dimensionality due to the nature of business itself. An "attitude" towards business might be towards big business, management as a class, or businessmen or managers as individuals; or they might be from the point of view of a citizen, a consumer or an employee.

Webster defines an attitude as a manner of feeling or acting or thinking which shows ones disposition. An image is a mental picture. The writers in the area of attitudes generally agree that attitudes involve feelings (liking-disliking or approval-disapproval) directed towards some referent or object.

For purposes of this study, attitudes will be considered as preparation for behavior or as Costello[1] defines them: the predisposition to evaluate some symbol or object or aspect of the world in a favorable or unfavorable manner (the verbal expression of this attitude is an opinion). There are two facets of attitudes; the affective, or feeling core of like or dislike, and the cognitive or belief element which describes the object of the attitude. When an attitude is described as strong, this intensity measure refers to the strength of the affective component.

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[1] Costello, Psychology and Administration .

The belief element of attitudes approaches what teachers sometimes call knowledge. In its broadest application, a belief implies mental acceptance or something as true, whether based on reasoning, prejudice or the authority of the source. Although the objective definition of knowledge is being sure of, or having a clear perception of, the subjective measurement of knowledge might often consist of measuring beliefs. When viewed in this context, the measurement of attitudes is to a certain extent the measurement of knowledge (or of beliefs which equal subjective knowledge). It is just as reasonable to argue that the knowledge teachers attempt to measure and instill is not significantly different from the belief component of attitudes. In any case subjective knowledge is very closely related to the belief component of an attitude and this relationship shall be exploited in this study.

1. FUNCTIONS OF ATTITUDES

Any discussion of attitudes must include some reference to the functions which attitudes perform for the individual, in order to be complete. Essentially, there are four functions which an attitude may perform for an individual: a) the instrumental, adjustive or utilitarian function, b) the ego-defensive function, c) the value-expressive function and d) the knowledge function.[2]

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[2] Festinger and Katz, Methods in Social Research, p. 255.

The adjustive function: People normally strive to maximize rewards in the external world and to minimize the penalties. Favorable attitudes tend to become associated with those objects associated with satisfaction of needs and unfavorable attitudes are associated with objects which thwart or punish. The closer these objects are to actual need satisfaction and the more they are clearly perceived as relevant to need satisfaction, the greater the probabilities for a positive attitude formation.

The ego-defensive function: A person protects himself from the basic truths about himself or the harsh realities of the external world by formation of suitable attitudes which serve as defense mechanisms. The attitude is not created by the object but by the individual's emotional conflict; if no object exists, he will create one as the need arises.

The value-expressive function: An individual derives satisfaction from expressing attitudes appropriate to his personal values and to his concept of himself. This helps explain why an individual tends to take over and internalize the values of a group with which he becomes associated. As the group moves towards its goals, it gives the individual the opportunity to participate, either by tapping his talents or abilities so that he has a chance to show what he is worth or by giving him an active voice in group decisions. If the individual can share in the rewards of group activity (which includes his own efforts), he may come to see himself as a group member and the values of the group will become highly consistent with his own values, usually through changing of the latter.

The knowledge function: This is based on the individual's need to give adequate structure or meaning to his universe. It does not imply an avid search for truth, but it does imply the desire to understand the events which impinge directly on his own life.

These functions have direct relevance for a study of attitudes towards business, especially if the people being studied are business students. A positive attitude formation should result where the object is perceived as relevant to need satisfaction; and a positive attitude towards business should be relevant to satisfying the needs of business students.

There are several "harsh realities" in the business world known to business students which interfere with the formation of a favorable image and the ego-defensive function of attitudes permits students to retain a favorable image of their chosen profession even in the face of such realities. When an attitude is challenged by a reality that is not in agreement with the attitude, the dissonance will be resolved in favor of the ego needs of the individual.

The knowledge function again underlines the important relationship of attitudes and knowledge and implies that attitudes tend to fill the gaps between random facts and bits of knowledge. It implies further that as individuals come into contact with new and different information regarding business, they will sort it into appropriate attitudes towards business.

2. EXISTENCE AND EXTENT OF STEREOTYPES

W. T. Tucker did an image study in response to a report done by J. Walter Thompson which indicated people tend to regard bankers as distant and formal. Tucker was concerned with the degree to which corporate images were stereotyped.

He used the Semantic Differential technique (a seven-point scale described by polar terms) and found high correlations between all types of companies studies (r's of .72 → .96). He found that the distribution of independent judgments showed strong central tendencies which indicated that the corporate images have similar structures which relate to the concept of stereotypical thinking. He concluded that:

> the generally favorable mean scores--and the limited range from highest to lowest score on each scale--might indicate that a business stereotype was working.[3]

Using the semantic differential he found that a large number of terms which seemed to have different (objective) meanings, measured only one (subjective) verbal dimension which was approval-dispproval. Some writers in the field would explain this phenomenon in other ways. Image formation is the result of limited capacity to absorb, sort and classify all the impressions impinging on an individual, and to abstract a meaning from them. Out of expedient necessity, a fuzzy abstraction is formed and then the individual tends to sort and classify additional impressions as they relate to this abstraction.

These abstractions will tend to be similar for members of homogeneous groups because they are created by roughly similar experience. It is possible for a corporation to be faceless--to have no image. If the object does not have a clearly defined image in terms of the perceiving group, it will tend to be more stereotyped than if it is familiar to the group.

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[3] W. T. Tucker, "How Much of Corporate Image is Stereotype?" Journal of Marketing, January, 1961.

Edward Hill has shown that other research does not substantiate this stereotype in image study. He claims that the appearance of a stereotype was obtained because: a) the respondents were unfamiliar with the object, b) the respondents were not given the proper set (to cooperate with rating task), and c) the center of the scale may have been used for irrelevant items.[4]

3. EXAMPLES OF PREVIOUS ATTITUDE RESEARCH IN BUSINESS

As was previously mentioned, attitudes toward business are highly complex and may be extremely variant, both in terms of object and source. Most attitude studies about business that exist in the literature refer to some particular job or group of managers and are not general enough to be called attitudes toward business or management.

Some studies have uncovered areas that seem to be universals, applying to business and managers in general, from all viewpoints (consumer, citizen, employee). One points out that there exists a folk memory of nineteenth century exploitation of the work force which makes workers suspicious of "improvement" that comes by way of automation or work measurement. Some of the specific findings of that study are:

a) The employee feels as though he is expendable and senses constant pressure to replace or get rid of him.

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[4] Edward Hill, "Corporate Images Are Not Stereotypes," Journal of Marketing, January, 1962.

b) The employee feels as though his life is being wasted on inconsequential tasks beneath his dignity and ability.

Some of middle management's thoughts:

c) That the "higher ups" will exploit people if they get a chance.

d) That there is a discrepancy between policy statement and expedient action.

e) That profits are put ahead of everything else.[5]

Some of the reasons postulated for these existing attitudes are the lack of or inadequacy of communication, the way management manages, and the unions and their negative propaganda campaigns.

The Bibliography contains several research studies and sources of attitude formation and change which give a good cross-section of attitudes.

4. ATTITUDE CHANGE

There has been much work in the area of attitude change and some of the findings of this work will be summarized here. Schein has proposed a model of influence and change which utilizes most of the current theories of attitude change. He states that attitude change is a three-stage operation: the first is unfreezing of the old attitude by increased pressure to change or decreasing the threat involved in changing; the second is changing or internalization of the new attitude where the new attitude is needed to solve the problem or reduce the dissonance. The last stage involves refreezing of the attitude. This needs social support from others who have been influenced or who hold the new attitude.[6]

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[5] "What Personnel Directors Think Employees Think," Management Record, 23: 8-16, December, 1961.

Other related theories touch on one or more of these stages and substantiate the Schein model as an explanation of attitude change. B. H. Nelson found that if an image appears stable and if reference groups surrounding the individual continue to support the image, both external (instruction, group pressure, group participation) and internal (personal interest, emotional or physical states and prejudices) forces opposing the image will be resisted.[7] This relates to the value-expressive function of attitudes previously discussed.

In regard to the ego-defensive function as related to the above, it has been shown that attitudes are seldom changed except through additional experience wherein the psychological defense which these attitudes often provide, is found to be unnecessary. This part of attitude change is extremely hard to research but it is possible to set the stage by establishing those conditions which help the individual to develop a greater awareness of himself and what he contributes to the development of the situation around him.

5. IMPLICATIONS FOR THIS RESEARCH PROJECT

There are several implications of the foregoing on the present project, some of which are practical in nature and others which are philosophical. Attitudes and images are nebulous at best and difficult to measure; and then it is hard to know what it is that has been measured. In relation to this it might be wise to avoid the use of the Semantic Differential technique because it yields subjective results that are not consistent with the objective criteria used in the measurement of attitudes. It was found that a large number of seemingly different adjective scales, in reality, consisted of a simple positive-negative evaluation. It might be more effective to use a measurement which uses this sort of evaluation directly.

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[6] Costello, Psychology in Administration, p. 308.

[7] B. H. Nelson, "Seven Principles in Image Formation," Journal of Marketing, January, 1962, pp. 67-71.

It is also necessary to avoid getting a stereotypical answer by properly instructing the respondents in their rating task. They should be cautioned against "systematizing" their answers in any way, either by placing them in the middle or on either end exclusively.

Because of the close relationship that exists between beliefs and knowledge, a valid and reliable "attitude" scale might also be construed to be capable of measuring the relative degree of knowledge of the respondents. In relation to this, it has been shown that where an attitude is made up of beliefs to a large extent, as opposed to feelings, it is much more difficult to change. This implies that attitudes expressed by simple value statements would be easiest to change.

There are indications in the literature and in the current news that opinion molders are becoming increasingly negative or apathetic towards business. The emphasis put on reference groups in attitude change and formation makes this an important consideration in the study of attitudes. To what extent are negative or positive attitudes generated by teachers? This is an important question to be answered, especially considering the relationship of attitudes to knowledge and the supposed role of the teacher.

A study done by England and Stein points out the importance of reference groups in an occupational setting.[8] The implications for research in an academic setting are that different academic groups have different attitudinal reference points and that scales or measurement devices should be adapted to their particular use with a particular group. This would facilitate a more meaningful measurement of change for a given group and for differences among groups and would also avoid that part of a stereotypical attitude that is caused by lack of uniform experience.

There are many special problems of management training and/or education that are difficult to solve and which the use of management decision games promises a happy solution, or at least, improvement over the past. Some of these are the difficulty of practice, and the students' need to experience as a whole that which the instructors must necessarily break down in order to communicate effectively. The area with which this paper is primarily concerned is the problem of how to overcome the attitudes of an individual and his limited self awareness--those attitudes toward authority, certain types of people, "big business," or business functions other than those he is preparing for, which do not permit him to accept the ideas presented. It is postulated that management decision games will overcome these attitudes through involvement or reduction of threats and need for defenses.

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[8] G. E. England and C. I. Stein, "Occupational Reference Groups: A Neglected Concept," Personnel Psychology, England, 1961, 14:4, pp. 299-304.

This study will attempt to measure quantitatively and qualitatively the extent to which these games do influence attitudes.

A note of caution; or pause for deliberation!

Most attitude, interest or aptitude tests used (for placement) are based on the theory that there are certain uniformities in the interests and personalities of persons which cause them to enter one profession rather than another, or at least be better suited for it.

Is interest a response of liking, or vice versa? What is the philosophical justification (other than removing barriers to learning) for attempting to change attitudes?

What attitudes are needed by a manager? The essential aspects of the managerial role have not as yet been clearly delineated: both the areas of knowledge to be mastered and the attitudes to be acquired are ambiguous. Against what norm are attitudes to be measured? Perhaps this study will provide some insight into these areas.

B. Introduction to Measuring Devices

There are several objectives that a measuring device for an attitude survey should attempt to attain:

- obtain some quantified measurement of "attitude" for each individual (place on a continuum)
- be able to discriminate between individuals
- be able to make relative comparisons
- establish a mean and range of scores
- measure change in some way
    - individual change
    - experimental versus control group change

- establish probability and direction of change for individuals treated in a certain way.

An attitude has been described in the previous section as:

- views, opinions and ideas held about some object
- approval - disapproval
- feelings of like or dislike directed towards an object
- a predisposition to evaluate an object in a favorable or unfavorable manner
- consisting of two elements: the affective or feeling core and the cognition or belief element.

A measuring device should show the respondent's feelings toward the object, his approval or disapproval, and his predisposition to evaluate positively or negatively; in short, his attitude toward the object.

Logically, this can be done by formulating a series of statements that express positive and negative views, opinions and ideas about business and obtaining responses to them on some approval-disapproval, like-dislike, favorable-unfavorable, positive or negative continuum. Agree-disagree applied to a series of statements, both positively and negatively worded would have this result.

Because beliefs are so closely related to knowledge it might be possible to measure the knowledge of the respondents indirectly by measuring their beliefs. This could be done in the same way; formulating some statements about business that are fact and some that are nonfact and then obtaining the respondent's opinion as to the "factness" of a statement. If the respondent agrees with fact statements and disagrees with nonfact statements, according to his beliefs, he is in effect demonstrating his knowledge.

1. ADVANTAGES AND DISADVANTAGES OF VARIOUS TYPES OF SCALES

The Semantic Differential technique is generally considered to be the closest approach to a ratio scale of any of the image rating techniques. It consists of rating the object on a continuum described by bipolar adjectives such as good-bad, weak-strong.

For purposes of this study, the disadvantages are so many that the advantages will not be discussed. Disadvantages of this technique are:

1) There is a limited number of bipolar adjectives that can refer to business and management.
2) Many of these adjectives merely measure approval or disapproval.
3) It is difficult to quantify or compare individuals.
4) A stereotype problem exists because:
    - of inadequate knowledge of object
    - there may be no image for respondent.

For these reasons, this type of scale will not be used.

There are two other techniques that will be discussed. These are the Thurstone equal-appearing interval technique and the Likert method. The Thurstone technique, as its name implies, proposes a psychophysical method of equal-appearing intervals for the measurement of attitudes. A large number of judges are required to sort statements into equal-appearing intervals along the continuum being investigated, ranging from very favorable through neutral to very unfavorable attitudes.

The Likert method uses a voting procedure wherein he found the per cent responding with each alternative (Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree) and after referring to the table of the normal curve, assigned scale values by weighting the alternatives.

Both scales are similar in that they provide techniques for selecting from an initially large number of items a set of items that will constitute the measuring device.

Empirical evidence suggests that the Likert technique does away with the need for judges and that results are comparable with the two methods. The Likert approach was found much easier to apply and yielded reliabilities as high as the Thurstone with fewer items. The Thurstone method is also criticized on the basis of the fact that it does not eliminate the least discriminating items in a large sample of items with similar scale values (rating by judges).

One of the objectives of a measuring device is to place an individual on a continuum but be able to discriminate between individuals. The Likert technique gives an individual a score by weighting each response (1 to 7) and adding up the total. Thus, for a 50 item test the scores could range from 50 to 350.

The Thurstone method gives an individual a score by computing the mean value of the items with which he agreed (range from 1.0 to 11.0). So the greater spread of scores available with the Likert method makes it more desirable in this respect.

Another objection to the Thurstone method is that it cannot measure the degree to which an item in the scale measures the same thing as the whole scale; that is, it has no validity check on the items. The need for agreement among the judges as to which of the eleven intervals an item should be placed in requires that the manifest content of the item relates rather directly to the attitude being measured.

In the Likert method there is no such need! By virtue of a higher value (correlation) the item can be proven diagnostic of the particular attitude in question, even though it bears no direct relationship to the attitude or object.

Discrimination refers to the extent to which respondents with different attitude complexions will respond in systemaiically different ways. Sharpness of discrimination refers to the ability of a scale to so discriminate along the entire scale. The Likert method has been shown to be most capable of selecting the most discriminating of the items and it is much more discriminating in the placement of individuals on the scale continuum. Those items with high r values, which is a check of internal consistency, are retained as being most discriminating. Past experience has shown that very favorable or unfavorable statements are best for use with the Likert method.

The absolute score derived from the Likert technique has no meaning by itself. It can be interpreted only in terms of where an individual's score falls, relative to the distribution of scores of others. The neutral point of the distribution is not known and it cannot be assumed to be the middle. But this technique does allow the use of means and establishes a range within which relative comparisons can be made.

Because of these technical advantages, a modified Likert technique will be used in this study.

2. VALIDITY AND RELIABILITY

Validity is the degree to which an item or scale measures that which it purports to measure. Validation carries with it the notion of prediction; if an item is valid, it measures the same thing that the whole scale measures and by looking at the score on an item it should be possible to predict what the total score will be, in approximate terms.

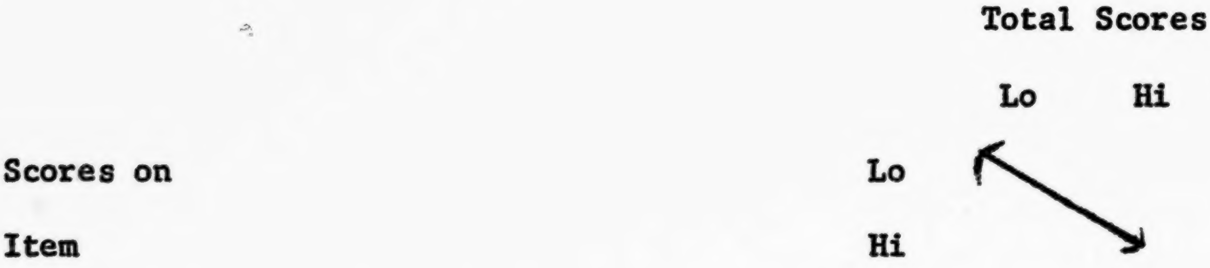
The whole scale is valid if it systematically relates the score to some outside objective criterion. The validation process, then, becomes one of determining the relationship between the two variables (the test score and the criterion).

The biserial correlation coefficient (r) can be used if one of the variables is expressed as a dichotomy; that is, pass or fail, agree or disagree, positive or negative evaluation. The validity of an item can then be determined by computing the r value and this will relate the item to the whole scale. This r is not a judgment. It is a number summarizing the relationship of what the item measures and what the whole scale measures. The validity can be controlled by raising or lowering the minimum r value needed for an item to be included in the final scale.

Reliability means consistency or precision and serves as a check on the extent to which a scale or item yields the same results over time. A question cannot be valid unless it is first reliable.

Validity for an item means that the item measures the same thing as the whole scale. This is operationally determined by computing the total score for each individual and comparing these to their scores on this item. If those individuals who had a high total score had a high score on this item and those with low total scores had low scores on this item the item is considered valid, and the degree of validity is summarized by r.

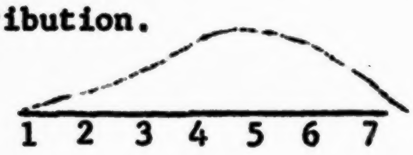
Graphically this looks like this:



If a question or item is used at two different times and has this same relationship both times, it means that the answers on this question had the same approximate distribution both times. In the aggregate, if only those questions with high r's are used, the scales will be measuring the same thing each time and reliability can be assured by using only those questions in the final scale that are valid both times the test is given.

It is possible for an individual or a group to change their answer from one time to another and not affect the reliability or validity of the question. This is demonstrated as follows:

For any given item, the distribution of scores on that item will approximate a normal distribution.

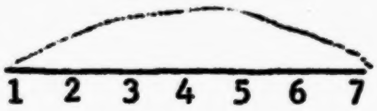


ITEM SCORE

If during the intervening time the group has had some experience that would cause them to change their attitude (make them raise their scores on that item), the distribution will then be skewed towards the upper end more than it was previously. But, since only valid questions are used the Hi-Hi, Lo-Lo relationship still holds.

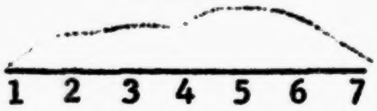
The same is true of groups that move in opposite directions as a result of experience or lack of it (experimental and control groups).

BEFORE



Item Scores

AFTER



Item Scores

But since the questions must be valid both before and after, those individuals who lowered their item scores will also be the ones who have lower total scores.

C. Construction of Measuring Scale

Because of the many components of "business" and the many perspectives for which it can be viewed, a complex scale was originally conceived that included attitudes toward "big" business, business in general, management, general value judgments, and concepts involved in the management decision game which the respondents would play (test of knowledge of these concepts). It included attitudes that might be held by employees, citizens and consumers (See Appendix III-5, Form 1).

The length of this test proved unwieldy and some of the subscales were found to be irrelevant so it was used in revised form. The scale was constructed as follows: the literature was searched for existing attitude studies and information relevant to attitudes toward management and business and statements were formulated using these ideas, which expressed an attitude or value judgment towards business or management. These statements were both positively and negatively worded. The sources are listed in the bibliography.

From knowledge of the decisions required and the important variable relationships involved in the decision game which Professor H. E Thompson developed, a series of statements was constructed which consisted of facts, and if negatively worded, nonfacts, involving concepts and relationships that the students should experience in playing the game.

The students were given a list of these statements referring either to business, management or concepts involved in the game (randomized) and they were asked to state their agreement or disagreement with each of the statements. They were given a choice of seven responses, ranging from Very Strongly Agree through Undecided to Very Strongly Disagree for each statement and were cautioned to avoid systematizing their answers in any way. They were also instructed in the importance of the rating task.

The object of the statements (business, management or concept) and their order in the list were randomized to avoid response sets, and they were worded both positively and negatively to avoid systematic responses by the students. In this way, by always strongly agreeing to each statement, they would have to contradict themselves to maintain this pattern.

Seven response categories were used because this would cause the answers and resulting scores to spread out more and better illustrate what was happening. There is also a psychological barrier that causes students to avoid using the extremes; if seven categories are in the scale, they will effectively use only five; if only five are used, they use only the middle three. The use of seven responses allows for this tendency and avoids clustering of scores which causes discrimination problems.

A student's score is computed as follows: If a statement is worded favorably towards business or management, or is a true statement of fact regarding a concept involved in the game, a Very Strongly Agree response is weighted by a seven (7), Undecided is a four (4), and a Very Strongly Disagree is a one (1). In this way, a person who has a very favorable attitude or is very knowledgeable will have a high score on this item.

If the statement is negatively worded or is not a fact, the weighting is reversed. Then the student's total score is computed separately for each of the three subscales (business, management, and concepts) by summing the weighted responses for all of the statements referring to that object. See Appendix III-1 for questions of Form II on each of the subscales.

Each student has three subscores at this stage, each representing the summated weights of his responses to the statements of one of the subscales. These scores at this stage are not validated.

Establishing the validity of the items: For each subscale, the summated weighted score for each individual is computed and these are then arrayed from highest to lowest. The highest and lowest (27% of the total in each group) scores are segregated for analysis. The proportion of each (high and low) group who agreed with a positive statement, which is the equivalent of "passing" the item, is computed and the ABAC table of Flanagan (see page 428 of Psychometric Methods, by J. P. Guilford) is referred to in order to determine the biserial correlation coefficient, r. A computer program was written to both compute the scores and to analyze the distribution of scores and calculate the proportion of each group who agreed with each statement. The table is then referred to in order to determine the r value of each item.

Getting Valid and Reliable Scores

Once the r values are computed it is possible to determine which items are to be used in the final scale. If an item has a high r value (greater than .30) this is taken to mean that the item is valid; that is, that it measures the same thing that the scale measures and it is retained as being valid for this particular scale used on this particular group.

It is possible to validate each item of each of the three subscales (business, management, concepts) in this way and it is also possible to validate each scale for every new group of students. This is in line with the work done on occupational reference groups which implies that business students might have different attitudinal reference points that nonbusiness, and graduate students different than undergraduates.

This test, consisting of three subscales, is given twice: before the experimental group play the game and then after game play is completed. The r value for each item is computed both times and the question is retained as being both valid and reliable if and only if the r value is greater than .30 both times. The final measuring device is made up of only those items in each subscale that have an r value greater than .30 both before and after treatment.

The valid and reliable scores for each individual on each of the three subscales are computed by summing the weighted responses on the valid items only.

Additional questions can be substituted for questions that are not valid and then tested for validity in subsequent use. Form IV lists 113 questions referring to knowledge of various aspects of business and these might be substituted for non-valid questions. Form IV was designed to be used in conjunction with the Harvard management decision game.

Form III of the attitude questionnaire was designed similarly to Form II and was intended for use with the Harvard game. The primary difference is that there were different concepts involved in the two games and the test was adjusted for this difference.

D. Results

The test or questionnaire was given to a group of subjects, 82 who played the game and 51 who did not play. It was given to both groups before the experimental group played the game and again after play.

Item Analysis

The following sheets summarize the item analysis which was done for each of the subscales. The first column lists the question numbers of the questions in each of the subscales. Then there is a before and after mean score for each item for each group and an indication of the magnitude of change. The direction of the change is included in the minus and positive difference columns.

The second and third last columns show the before and after r values of each item and the last column shows the status of the question: in = included as valid and reliable, out = not to be included, R and Δ mean included because of revision or large changes that require further investigation before being excluded. Generally a question is included only if both r values are .30 or greater. Appendix II lists those questions in each subscale which are included in the final scale as being valid and reliable.

BUSINESS = 1

	Played				Didn't				r		Ques-
Ques-tion	Before	After	Δ -	+	Before	After	Δ -	+	Before	After	tion Status
1	5.45	5.68		.23	5.51	5.70		.19	.38	.55	In
4	4.04	4.03	.01		3.83	3.98		.15	.37	.41	In
5	5.93	5.95		.02	5.98	5.96	.02		.29	.40r	Out
7	5.89	5.82	.07		5.89	5.79	.10		.55	.65	In
10	4.32	4.16	.16		4.24	4.11	.13		.58	.47	In
14	3.94	4.03		.09	3.38	3.96		.58	.34	.30	In
15	4.16	4.60		.44	4.14	4.53		.39	.53	.58	In
19	5.17	4.98	.19		4.97	5.04		.07	.05	.08	Out
20	5.11	5.27		.16	4.79	5.17		.38	.40	.40	In
21	4.28	4.33		.05	4.24	4.13	.11		.10	.10	Out
22	4.38	4.17	.21		3.65	4.11		.46	.25	.37	±
26	4.89	4.98		.09	5.06	4.98	.08		.43	.50	In
27	4.60	4.83		.23	4.56	4.87		.31	.47	.52	In
30	4.65	4.61	.04		4.59	4.66		.07	.12	.24	Out
32	5.31	5.55		.24	5.35	5.72		.37	.16	.30	Δ
36	4.45	4.64		.19	4.10	4.13		.03	.26	.32	Out
39	4.28	4.47		.19	4.14	3.89	.25		.40	.36	In
40	3.61	3.63		.02	3.81	3.53	.28		.50	.75	In
41	4.55	4.60		.05	4.16	4.36		.20	.68	.77	In
42	5.39	5.48		.09	5.35	5.36		.01	.60	.47	In
44	4.34	4.32	.02		4.48	5.00		.52	.30	.24	Δ
45	3.88	3.78	.10		3.71	3.58	.13		-.05	.09	Out
49	6.09	6.26		.17	6.17	5.79	.38		.33	.39	In
51	5.33	5.59		.26	5.56	5.58		.02	.65	.65	In

- more -

Business = 1 (Continued)

Question	Played		Δ		Didn't		Δ		r		Question Status
	Before	After	-	+	Before	After	-	+	Before	After	
52	5.42	5.32	.10		5.44	5.04	.40		.10	.14	Out
55	5.73	5.65	.08		5.57	5.68		.11	.15	.55r	r
56	4.36	4.37		.01	4.27	4.26	.01		.30	.33	In
60	5.20	5.28		.08	4.87	5.19		.32	.35	.40	In
61	4.74	4.67	.07		4.63	4.25	.38		.42	.32	In
63	5.50	5.51		.01	5.40	5.30	.10		.40	.40	In
68	4.97	4.89	.08		5.05	5.08		.03	.32	.30	In
69	3.46	3.34	.12		3.63	3.53	.10		.38	.18	Out
71	5.10	5.09	.01		5.05	5.17		.12	.32	.28	Out
72	5.15	5.30		.15	5.33	5.40		.07	.30	.20	Out
73	5.27	5.05	.22		5.32	4.94	.38		.25	.19	Δ
74	3.49	3.15	.34		3.44	3.45		.01	.10	.27	Out
75	5.82	5.82			5.75	5.85		.10	.0	-.40	Out
77	4.15	4.20		.05	3.76	4.00		.24	.08	.10	Out

MANAGEMENT = 2

	Played				Didn't						Ques-tion
Ques-			Δ				Δ		r		tion
tion	Before	After	-	+	Before	After	-	+	Before	After	Status
2	4.88	4.89		.01	4.79	4.85		.06	.45	.44	In
5	5.93	5.95		.02	5.98	5.96	.02		.60	.55	In
12	3.32	3.29	.03		3.32	3.25	.07		.40	.20	Out
16	5.49	5.63		.14	5.48	5.30	.18		.0	.28	Out
18	5.09	5.14		.05	5.29	5.08	.21		.17	.50r	r
24	2.61	2.73		.12	2.46	2.77		.31	.12	.26	Out
25	4.02	4.15		.13	4.32	4.00	.32		.50	.41	In
28	4.97	4.99		.02	4.70	4.77		.07	.49	.50	In
29	4.25	4.35		.10	4.14	4.43		.29	.40	.30	In
30	3.63	3.65		.02	3.54	3.62		.08	.19	.35	Out
34	5.55	3.40	.15		5.30	5.32		.02	.70	.50	In
35	4.43	4.18	.25		4.62	4.66		.04	.20	-.10	Out
36	4.45	4.64		.19	4.10	4.13		.03	.40	.60	In
37	4.60	4.35	.25		4.68	4.55	.13		.30	.0	Out
43	4.33	4.17	.16		4.29	4.17	.12		.58	.41	In
46	4.16	4.50		.34	3.92	4.26		.34	.36	.16	Out
47	4.56	4.58		.02	4.41	4.36	.05		.38	.40	In
48	4.00	3.76	.24		3.70	3.92		.22	.55	.50	In
52	5.42	5.32	.10		5.44	5.04	.40		.22	.0	Out
54	4.94	4.76	.18		4.81	4.68	.13		.34	.47	In
57	3.97	4.12		.15	4.17	4.06	.11		.28	.30	In
58	4.14	4.48		.34	4.29	4.32		.03	.33	.47	In
59	4.58	4.76		.18	4.86	4.85	.01		.19	.12	Out

Management = 2 (Continued)

	Played		Δ		Didn't		Δ		r		
Question	Before	After	-	+	Before	After	-	+	Before	After	Question Status
61	4.74	4.67	.07		4.63	4.25	.38		.33	.44	In
63	5.50	5.51		.01	5.40	5.30	.10		.65	.65	In
65	4.72	4.84		.12	4.86	4.77	.09		.09	.20	Out
68									.30	.21	Out
70	4.01	4.16		.15	3.90	3.83	.07		.32	.25	Out
74	3.49	3.15			3.44	3.45			.18	.30	Out
75	5.82	5.82			5.75	5.85		.10	.0	.40	Out
76	4.14	3.76	.38		4.08	4.08			.24	-.03	Out

CONCEPTS = 3

	Played				Didn't						
			Δ				Δ		r		Ques-tion
Question	Before	After	-	+	Before	After	-	+	Before	After	Status
3	5.40	5.51		.11	5.54	5.57		.03	.17	.30 -	Out
6	4.37	4.34	.03		4.38	4.26	.12		.07	.19 -	Out
8	5.18	5.36		.18	5.30	5.23	.07		.32	.40	In
9	5.00	4.90	.10		4.84	5.34		.50	.18	.42	±Δ
11	5.18	6.29		1.11	4.90	4.38	.52		.52	.53r	In
13	4.77	4.85		.08	4.43	4.66		.23	.24	.30 -	Out
17	4.22	4.32		.10	4.44	3.68	.76		.30	.39r	In
23	5.62	5.71		.09	5.78	5.51	.27		.55	.30	In
31	3.69	3.65	.04		3.54	3.62		.08	.33	.31	In
33	4.59	4.97		.38	4.62	5.13		.51	.42	.42	In
38	5.89	5.76	.13		5.75	5.70	.05		.15	.55r	r
39	4.28	4.47		.19	4.14	3.94	.20		.23	.33	∓
50	3.68	3.67	.01		3.83	3.64	.19		.19	.02 -	Out
53	4.13	4.07	.06		3.86	3.93		.12	.33	.34	∓
59	4.58	4.76		.18	4.86	4.85	.01		.13	.13 -	Out
62	5.58	5.85		.27	5.76	5.96		.20	.30	.40r	In
64	5.29	5.30		.01	4.89	5.00		.11	.28	.41	Out
66	4.14	4.16		.02	4.02	4.36		.34	.07	.14	Δ
67	5.46	5.64		.18	5.23	5.40		.17	.29	.38 -	Out
68	4.97	4.89	.08		5.05	5.08		.03	.36	.33 -	In
69	3.46	3.34	.12		3.63	3.53	.10		.30	.68 -	In

The probability of direction of change for both the experimental and control groups on each of the three subscales was computed to find the result of the game on the experimental group. These results are summarized below.

EXPERIMENTAL GROUP:

	Attitude			Towards					
	Towards Business			Management			Concepts		
Direction of change	(+)	0	(-)	(+)	0	(-)	(+)	0	(-)
Number	50	4	28	41	2	39	39	5	38
Proportion	.61		.34	.50		.48	.48		.46

CONTROL GROUP:

Direction	(+)	0	(-)	(+)	0	(-)	(+)	0	(-)
Number	31	0	20	19	5	27	21	4	26
Proportion	.61		.39	.37		.53	.41		.51

As can be seen, the probability is greatest that the direction of change will be positive for all three subscales of the test but for the experimental group only. For the control group, only the first subscale has a probability of positive change that is greater than the probability of a negative change. This means that generally, the results of playing the game are to improve the players' attitudes toward business and management and to improve their knowledge of the concepts involved in the game. In most cases, however, the differences are slight and not statistically significant.

The change in scores on each of the three subscales for both the experimental and control group was analyzed also and the group means are shown below:

EXPERIMENTAL GROUP:

	Attitude Towards Business	Towards Management	Concepts
Before Mean	96.4	77.5	58.2
After Mean	98.3	78.7	58.5
CONTROL GROUP:			
Before Mean	104.8	72.2	58.0
After Mean	107.1	75.8	57.2

As can be seen, the difference between the before and after measurements is not as great as the difference between the experimental and control groups so that they are not significant, either statistically or logically.

It might be postulated that since the playing of the game was the only treatment difference between the groups, and since there is no significant change between the groups, the game does not furnish enough information to enable the students to change their attitudes or the students do not involve themselves enough. Perhaps no attitude change is required to make the decisions necessary.

A further consideration is that averages tend to even out differences, by definition. It is possible that significant changes might occur in opposite directions and cancel each other out in the averages. An analysis of the change in scores for each item for both groups would isolate those items which differentiated the two groups. This would be a better indication of what effect playing the game had on the experimental group. A summary of those questions which showed a relatively large differential effect on the two groups follows below:

ATTITUDE TOWARDS BUSINESS

QUESTION	CHANGE*		
No.	Exp.	Control	Question Content
22	-.21	.46	Business can't maintain high prices
26	.09	-.08	Personal views similar to some one pro-business
39	.19	-.25	Businesses receive more than fair rate of return
40	.02	-.28	Business should have more control in country
44	-.02	.52	Maintaining competition better than maximum efficiency
49	.17	-.38	Business should be regulated by the government
55	-.08	.11	Growth is due to situational rather than productive factors

See Appendix III-3 for other large changes in same direction.

*Based on maximum theoretical change of 6.0.

ATTITUDE TOWARDS MANAGEMENT

QUESTION	CHANGE		
No.	Exp.	Control	Question Content
25	.13	-.32	Union propaganda against management has hurt labor
34	-.15	+.02	Management tends to exploit labor
48	-.24	.22	Advantages to labor from competition, not management
57	.15	-.11	Labor more motivated by money than management
63	.01	-.10	Business characterized by lack of ethics

- more -

KNOWLEDGE OF GAME CONCEPTS

QUESTION CHANGE			
No.	Exp.	Control	Question Content
8	.18	-.07	Ability to borrow any time
11	1.11	-.52	Share of market versus profit
17	.10	-.76	Profit margin versus large share of market
23	.09	-.27	Better to charge higher price than lower production costs
31	-.04	.08	Structured vs. committee type management
68	-.08	.03	Blame for recession
9	-.10	.50	R & D on production rather than product
39	.19	-.20	Most businesses receive more than fair rate of return
53	-.06	.12	Businesses produce efficiently (at capacity)

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APPENDIX III-1

QUESTIONS IN FORM II IN EACH SUBSCALE

I PRO-CON BUSINESS:

1, 4, 5, 7, 10, 14, 15, 19, 20, 21, 22, 26, 27, 30, 32, 36, 39, 40, 41, 42, 44, 45, 49, 51, 52, 55, 56, 60, 61, 63, 68, 69, 71, 72, 73, 74, 75, 77.

II PRO-CON MANAGEMENT:

2, 5, 12, 16, 18, 24, 25, 28, 29, 31, 34, 35, 36, 37, 43, 46, 47, 48, 52, 54, 57, 58, 59, 61, 63, 65, 68, 70, 74, 75, 76.

III KNOWLEDGE OF CONCEPTS:

3, 6, 8, 9, 11, 13, 17, 23, 31, 33, 38, 39, 50, 53, 59, 62, 64, 66, 67, 68, 69.

APPENDIX III-2

VALID QUESTIONS FOR EACH SUBSCALE OF FORM II, FOR 1st SEMESTER MARKETING CLASS

I BUSINESS:

1, 4, 7, 10, 14, 15, 20, 22, 26, 27, 39, 40, 41, 42, 49, 51, 55, 56, 60, 61, 63, 68.

II MANAGEMENT:

2, 5, 18, 25, 28, 29, 34, 36, 43, 47, 48, 54, 57, 58, 61, 63.

III KNOWLEDGE OF CONCEPTS:

8, 9, 11, 17, 23, 31, 33, 39, 53, 62, 68, 69.

APPENDIX III-3

ATTITUDES TOWARD BUSINESS

Business			
1	.23	.19	business should be able to earn = private
4	-.01	.15	little man preserved and protected
7	-.07	-.10	government control (regulate) prices
10	-.16	-.13	survival of fittest should not be allowed
14	.09	.58	most goods could be sold for less and still be profitable
15	.44	.39	business profits not excessive
20	.16	.38	quality and mass production are inconstant
22	-.21	.46	business can't maintain high prices
26	.09	-.08	personal views similar to some one pro business
27	.23	.31	monopoly more bad than good
39	.19	-.25	businesses receive more than fair rate of return
40	.02	-.28	business should have more control in country
41	.05	.20	large corporations have too much power
44	-.02	.52	maintaining company should be considered before maximum efficiency
49	.17	-.38	business should be controlled (regulated) by government
51	.26	.02	business share of tax load
55	-.08	.11	growth due to situational rather than productivity
60	.08	.32	business responsibility for maintaining high level of employment
61	-.07	-.38	workers have jobs beneath dignity
63	.01	-.10	business characterized by lack of ethics
68	-.08	-.03	to blame for recession
73	-.22	-.38	new products introduced by big firms
32	.24	.37	premium rate of return for innovation

Appendix III (Continued)

Where is there a difference?

Concepts

8	.18	-.07	financial backing or borrow
11	1.11	-.52	share of market vs. profit
17	.10	-.76	profit margin vs. large share of market
23	.09	-.27	better to charge higher price than lower costs through production
31	-.04	+.08	structured vs. committee type management resistant to change
33	+.38	+.51	effects of advertising
62	+.27	+.20	value of business statements
68	-.08	+.03	blame for recession
69	-.12	-.10	competition preserved at all costs
9	-.10	+.50	R & D to work on production rather than product
39	+.19	-.20	most businesses receive more than fair rate
53	-.06	+.12	business produce efficiently - at capacity

Management

25	.13	-.32	union propaganda against management hurt worker
29	.10	+.29	management belief that labor attempts minimum
34	-.15	+.02	"tends to exploit labor - not pay worth"
36	.19	+.03	concern with job security when set plans
43	-.16	-.12	management exerts constant pressure to replace labor
48	-.24	+.22	advantage to employees from company or union - not management
54	-.18	-.13	management considers labor expendable
57	.15	-.11	labor more motivated by dollars than management

Appendix III (Continued)

Mgmt. (Cont.)

58	.34	+.03	management views profit more important than labor relations
61	-.07	-.38	workers have jobs beneath dignity
63	.01	-.10	business characterised by lack of ethics
18	.05	-.21	job of management to achieve return on capital

APPENDIX III-4

SUBSCALE OF FORM I (UNREVISED)

Pro-Anti Big Business

2, (3), (5), 6, 7, 8, 9, 14, 15, 16, 17, 18, 19, 21, 22, 25, 27, 35, 36, 37, 39, 40, 42, (41), 43.

Evaluative - Idea - (Knowledge)

1, 3, (5), 6, 7, 9, 10, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40,,42, (41), 43.

Pro-Anti Business (in general)

9, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, (41), 43.

Big vs. Small Business

4, (5), 6, 7, 8, 9, 10, 11, 17-18, 25, 34, 35, 36, 37, 38, 39, 40, 42, (41), 43.

Pro-Anti Management

9, 10, 11, 12, 13, 16, 19, 20, 21, 22, 23, 24, 26, 28, 29, 30, 31, 32, 33, 34, 35, 38.

Applies to Game

1, 7, 9, 16, 17, 18, 20, 21, 22, 24, 25, 26, (28), 29, 31, 32, 33, 34, 35, 36, 39, 40, 42, (41).

Employee Attitudes

11, 12, 16, 17, 18, 22, 27, 28, 30, 31, 38, 43.

Citizens Views

14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 32, 33, 35, 36, 37, 38, 39, 40, 42, (41), 43.

Consumer Views

17, 18, 20, 21, 24, 25, 26, 27, 30, 31, 32, 35, 36, 39, 40, 42, (41).

Appendix V Questionnaire

FORM I (UNREVISED)

This is a questionnaire designed to get at your ideas, opinions, and beliefs about business and its various aspects. Answer it as best you can as it relates to how you feel.

Do not neglect the rating task by grouping your answers at one end of the scale or in the middle. Try your best to discriminate those answers which best represent your fellings or beliefs for each item.

If the question of definition of terms arises, answer in terms of the way you would define the term.

The answer code is as follows:

VSA = Very Strongly Agree
SA = Strongly Agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree
VSD = Very Strongly Disagree

Circle that response for each item that best represents your attitude.

Circle One	
VSA SA A U D SD VSD	1. Businesses should be able to earn as great a return on their investment as private individuals do.
VSA SA A U D SD VSD	2. "Conscientious and principled" are terms that might well be applied to management.
VSA SA A U D SD VSD	3. It is good business to sell direct to the customer and not use a middleman because he takes a part of the profit.
VSA SA A U D SD VSD	4. The smaller the company, the more fair are labor policies and relations.
VSA SA A U D SD VSD	5. Efficiency is directly related to size in business organizations.
VSA SA A U D SD VSD	6. The "little man" in business should be preserved and protected.
VSA SA A U D SD VSD	7. Management is more concerned with quality in a small firm than in a large one.
VSA SA A U D SD VSD	8. A person has greater job security working for a smaller business than for a large business.
VSA SA A U D SD VSD	9. Labor unions should be more powerful than business management.
VSA SA A U D SD VSD	10. In a business situation, solving the interpersonal relations is more difficult than solving the problems themselves.
VSA SA A U D SD VSD	11. The government should control the prices that business set.
VSA SA A U D SD VSD	12. Big business contributes greatly to improved economic conditions and raised standards of living.
VSA SA A U D SD VSD	13. A business concern can usually get financial backing or borrow money, regardless of its position or condition.
VSA SA A U D SD VSD	14. It's more advantageous for Research and Development to work on new and better production processes than on product development.
VSA SA A U D SD VSD	15. Survival of the fittest should not be allowed to dominate the big vs. small business conflict.

Circle One	
VSA SA A U D SD VSD	16. Obtaining a larger share of the market is better than obtaining a larger profit.
VSA SA A U D SD VSD	17. There is often a discrepency between policy statement and expendiant action on the part of management.
VSA SA A U D SD VSD	18. The beneficial effects of money spent on Research and Development are directly proportional to the amount spent.
VSA SA A U D SD VSD	19. Most goods could be sold for less and still yeild a fair profit.
VSA SA A U D SD VSD	20. Big business profits are not excessive.
VSA SA A U D SD VSD	21. What efficiency a large company has is mostly due to its larger amount of machinery, etc., rather than the skill of its management.
VSA SA A U D SD VSD	22. A large profit margin is more important than a large share of the market.
VSA SA A U D SD VSD	23. The major job responsibility of management is to achieve a satisfactory return on capital invested.
VSA SA A U D SD VSD	24. Good management is more necessary in a small business than in a large business.
VSA SA A U D SD VSD	25. "Big Business" is determined by the amount of profits earned.
VSA SA A U D SD VSD	26. Quality and mass production are inconsistent.
VSA SA A U D SD VSD	27. The bad things that happen because of monopoly outweigh the advantages of being able to produce more efficiently.
VSA SA A U D SD VSD	28. Business, as a rule, doesn't have the power to maintain high prices.
VSA SA A U D SD VSD	29. It is better for a firm to meet the costs of production by charging a high price than by maintaining production efficiency and lowering costs.
VSA SA A U D SD VSD	30. Granted that larger businesses pay higher wages, the main reason is that management is more interested in the workers.

Circle One

VSA SA A U 31. The unions'negative propaganda against management has hurt the worker in the long run.
D SD VSD

VSA SA A U 32. My personal views are similar to those of someone who is pro business.
D SD VSD

VSA SA A U 33. The disadvantageous social effects of business concentration outweigh the beneficial effects of optimum efficiency.
D SD VSD

VSA SA A U 34. Business management.is impersonal and distant.
D SD VSD

VSA SA A U 35. Management's belief is that the labor force is always trying to do the minimum rather than the maximum.
D SD VSD

VSA SA A U 36. Business puts profit ahead of everything.
D SD VSD

VSA SA A U 37. A large proportion of job opportunities are generated by big business.
D SD VSD

VSA SA A U 38. A highly structured management hierarchy is more resistant to change than a committee-type management.
D SD VSD

VSA SA A U 39. A premium rate of return should accrue to businesses that assume the risk of innovation.
D SD VSD

VSA SA A U 40. It is usually possible to tell pretty closely what the effects of money spent on advertising are.
D SD VSD

VSA SA A U 41. Management tends to exploit labor and not pay them their worth.
D SD VSD

VSA SA A U 42. The job of management is to impress people with the fact that profits are good for employees.
D SD VSD

VSA SA A U 43. Businessmen are concerned with job security for their workers when they established plans and policy.
D SD VSD

VSA SA A U 44. Effective management is the same as shrewd management.
D SD VSD

VSA SA A U 45. A strong executive who controls all of the decisions will be more successful than one who confers with his staff.
D SD VSD

VSA SA A U 46. Large firms will let quality slip to maintain price sooner than a small firm would.
D SD VSD

Circle One		
VSA SA A U D SD VSD	47.	Most businesses receive more than a fair rate of return.
VSA SA A U D SD VSD	48.	Business should have more control over what goes on in this country.
VSA SA A U D SD VSD	49.	Large corporations have too much power.
VSA SA A U D SD VSD	50.	The bad effects of big business activity outweight the good effects.
VSA SA A U D SD VSD	51.	Management exerts a constant pressure to get rid of or replace labor through mechanization and method changes.
VSA SA A U D SD VSD	52.	In determining optimum size, maintaining competition should be considered before obtaining maximum efficiency.
VSA SA A U D SD VSD	53.	The profit margin of small firms is generally higher than that of a large firm.
VSA SA A U D SD VSD	54.	The free enterprise system is the backbone of the American economy.
VSA SA A [✓ U] D SD VSD	55.	Big business is not "bad" but neutral.
VSA SA A U D SD VSD	56.	In spite of good management, a company may not move unless it "gets the breaks."
VSA SA A U D SD VSD	57.	Managers generally encourage the workers to get involved in their jobs and arrange the work load so that the workers are not rushed.
VSA SA A U D SD VSD	58.	Most of the advantages benefits and privileges which have accrued to employees are a result of competition or union pressure rather than an enlightened management.
VSA SA A U D SD VSD	59.	Big business is more apt to "close up shop and move out" than a small firm would be.
VSA SA A U D SD VSD	60.	Business should be controlled by the government.
VSA SA A U D SD VSD	61.	It is not good business to forego interest on investments so that the money will be available for investment in the business.

Circle One

VSA SA A U D SD VSD 62. Business does not carry its share of the tax load.

VSA SA A U D SD VSD 63. A shopper would get a more fair deal at a small store than at a big one.

VSA SA A U D SD VSD 64. Small business profits are excessive.

VSA SA A U D SD VSD 65. Big business has been mainly responsible for new product innovation.

VSA SA A U D SD VSD 66. Businesses usually produce efficiently; that is, at or near capacity.

VSA SA A U D SD VSD 67. Large firms offer better prices to consumers than small firms do.

VSA SA A U D SD VSD 68. Generally speaking, management considers labor as expendable.

VSA SA A U D SD VSD 69. To be successful in business all you have to do is price high and sell well.

VSA SA A U D SD VSD 70. Quality control is more predominate in larger firms.

VSA SA A U D SD VSD 71. The growth of large business units is due to situational factors or unethical practices rather than to productive qualities.

VSA SA A U D SD VSD 72. When a firm is involved in an antitrust suit, the court of public opinion usually judges it guility, whether it is or not.

VSA SA A U D SD VSD 73. Labor is more motivated by money than management is.

VSA SA A U D SD VSD 74. Profit is viewed by management as being more important than good labor relations.

VSA SA A U D SD VSD 75. The larger the company, the higher the wages paid to employees.

VSA SA A U D SD VSD 76. The major job responsibilities of management is to achieve a satisfactory return on capital invested.

Circle One		
VSA SA A U D SD VSD	77.	Good management is more important than financial backing in contributing to company success.
VSA SA A U D SD VSD	78.	Big business is responsible for maintaining a high level of employment.
VSA SA A U D SD VSD	79.	Most workers have jobs which are inconsequential and unmeaningful tasks beneath their ability.
VSA SA A U D SD VSD	80.	Business statements are not of much value in charting the progress of a company.
VSA SA A U D SD VSD	81.	Business is characterized by lack of ethics.
VSA SA A U D SD VSD	82.	As regards management-employee relations, the attitudes of management in small business are more desirable than big business managers.
VSA SA A U D SD VSD	83.	Business should not worry about stable employment but should hire and fire as the need arises.
VSA SA A U D SD VSD	84.	Skill and resourcefulness of management is mostly responsible for a small business' degree of efficiency.
VSA SA A U D SD VSD	85.	Business can stay ahead of a recession by using contracyclical pricing.
VSA SA A U D SD VSD	86.	In successful companies, salesmanship is more important than satisfactory products.
VSA SA A U D SD VSD	87.	It costs more for a big firm to do a job than what it would cost a small firm to do the same job.
VSA SA A U D SD VSD	88.	When a recession occurs, no one group in the economy is to blame for causing it.
VSA SA A U D SD VSD	89.	Competition should be preserved at all costs.
VSA SA A U D SD VSD	90.	Retention of profits in the business is more common in small business than in big business.
VSA SA A U D SD VSD	91.	Management is more responsible for efficiency than mass production techniques and mechanization are.

Circle One

VSA SA A U 92. People should shop the small outlets because the little fellow needs a break.
D SD VSD

VSA SA A U 93. Community welfare, education and philanthropic endeavors are supported by business.
D SD VSD

VSA SA A U 94. Most new products are not introduced by big firms.
D SD VSD

VSA SA A U 95. "The Organization Man" is more real than fiction in American business.
D SD VSD

VSA SA A U 96. The quality of a product is dependent on factors other than the size of the firm.
D SD VSD

VSA SA S U 97. Poor management can sell a good product but good management cannot sell a poor product.
D SD VSD

VSA SA S U 98. The state of the economy has very little effect on the invidivual business concern.
D SD VSD

VSA SA S U 99. The 4½% rate of interest offered by banks is a fair rate of return for private investment.
D SD VSD

Circle One

VSA SA A U
D SD VSD
15. Big business profits are not excessive.

VSA SA A U
D SD VSD
16. What efficiency a large company has is mostly due to its larger amount of machinery, etc., rather than the skill of its management.

VSA SA A U
D SD VSD
17. A large net profit margin is more important than a large share of the market.

VSA SA A U
D SD VSD
18. A major job responsibility of management is to achieve a satisfactory return on capital invested.

VSA SA A U
D SD VSD
19. "Big Business" is determined by the amount of profits earned.

VSA SA A U
D SD VSD
20. Quality and mass production are inconsistent.

VSA SA A U
D SD VSD
21. The bad things that happen because of monopoly outweigh the advantages of being able to produce more efficiently.

VSA SA A U
D SD VSD
22. Business, as a rule, doesn't have the power to maintain high prices.

VSA SA A U
D SD VSD
23. It is better for a firm to meet the costs of production by charging a high price than by maintaining production efficiency and lowering costs.

VSA SA A U
D SD VSD
24. Granted that larger businesses pay higher wages, the main reason is that management is more interested in the workers.

VSA SA A U
D SD VSD
25. The unions negative propaganda against management has hurt the worker in the long run.

VSA SA A U
D SD VSD
26. My personal views are similar to those of someone who is pro business.

VSA SA A U
D SD VSD
27. The disadvantageous social effects of business concentration outweigh the beneficial effects of optimum efficiency.

VSA SA A U
D SD VSD
28. Business management is impersonal and distant.

VSA SA A U
D SD VSD
29. Management's belief is that the labor force is always trying to do the minimum rather than the maximum.

FORM II MARKETING GAME

Circle One

VSA SA A U D SD VSD 1. Businesses should be able to earn as great a return on their investment as private individuals do.

VSA SA A U D SD VSD 2. "Conscientious and principled" are terms that might well be applied to management.

VSA SA A U D SD VSD 3. It is sometimes good business to sell direct to the customer and not use a middleman because he takes a part of the profit.

VSA SA A U D SD VSD 4. The "little man" in business should be preserved and protected.

VSA SA A U D SD VSD 5. Labor unions should be as powerful as business management.

VSA SA A U D SD VSD 6. In a business situation, solving the interpersonal relations is sometimes more difficult than solving the problems themselves.

VSA SA A U D SD VSD 7. The government should regulate the prices that business sets.

VSA SA A U D SD VSD 8. A business concern can usually get financial backing or borrow money, regardless of its position or condition.

VSA SA A U D SD VSD 9. It's more advantageous for Research and Development to work on new and better production processes than on product development.

VSA SA A U D SD VSD 10. Survival of the fittest should not be allowed to dominate the big vs. small business conflict.

VSA SA A U D SD VSD 11. Obtaining a larger share of the market is more important than obtaining a larger profit.

VSA SA A U D SD VSD 12. There is often a discrepency between policy statement and expendiant action on the part of management.

VSA SA A U D SD VSD 13. The beneficial effects of money spent on Research and Development are generally directly proportional to the amount spent.

VSA SA A U D SD VSD 14. Most goods could be sold for less and still yield a fair profit.

Circle One	
VSA SA A U D SD VSD	30. Business puts profit ahead of everything.
VSA SA A U D SD VSD	31. A highly-structured management hierarchy is more resistant to change than a committee-type management.
VSA SA A U D SD VSD	32. A premium rate of return should accrue to businesses that assume the risk of innovation.
VSA SA A U D SD VSD	33. It is usually possible to tell pretty closely what the effects of money spent on advertising are.
VSA SA A U D SD VSD	34. Management tends to exploit labor and not pay them their worth.
VSA SA A U D SD VSD	35. The job of management is to impress people with the fact that profits are good for employees.
VSA SA A U D SD VSD	36. Businessmen are concerned with job security for their workers when they established plans and policy.
VSA SA A U D SD VSD	37. Effective management is the same as shrewd management.
VSA SA A U D SD VSD	38. An executive who controls all of the decisions will be more successful than one who confers with his staff.
VSA SA A U D SD VSD	39. Most businesses receive more than a fair rate of return.
VSA SA A U D SD VSD	40. Business should have more control over what goes on in this country.
VSA SA A U D SD VSD	41. Large corporations have too much power.
VSA SA A U D SD VSD	42. The bad effects of big business activity outweigh the good effects for society as a whole.
VSA SA A U D SD VSD	43. Management exerts a constant pressure to get rid of or replace labor through mechanization and method changes.
VSA SA A U D SD VSD	44. In determining optimum size, maintaining competition should be considered before obtaining maximum efficiency.
VSA SA A U D SD VSD	45. The profit margin of small firms is generally higher than that of a large firm.

Circle One	
VSA SA A U D SD VSD	46. In spite of good management, a company may not it "gets the breaks."
VSA SA A U D SD VSD	47. Managers generally encourage the workers to get involved in their jobs and arrange the work load so that the workers are not rushed.
VSA SA A U D SD VSD	48. Most of the advantages benefits and privileges which have accrued to employees are a result of competition or union pressure rather than an enlightened management.
VSA SA A U D SD VSD	49. Business should be regulated by the government.
VSA SA A U D SD VSD	50. It is not good business to forego interest on investments so that the money will be available for investment in the business.
VSA SA A U D SD VSD	51. Business does not carry its share of the tax load.
VSA SA A U D SD VSD	52. Big business has been mainly responsible for new product innovation.
VSA SA A U D SD VSD	53. Businesses usually produce efficiently; that is, at or near capacity.
VSA SA A U D SD VSD	54. Generally speaking, management considers labor as expendable.
VSA SA A U D SD VSD	55. The growth of large business units is due to situational factors rather than to productive qualities.
VSA SA A U D SD VSD	56. When a firm is involved in an antitrust suit, the court of public opinion usually judges it guilty, whether it is or not.
VSA SA A U D SD VSD	57. Labor is more motivated by money than management is.
VSA SA A U D SD VSD	58. Profit is viewed by management as being more important than good labor relations.
VSA SA A U D SD VSD	59. Good management is more important than financial backing in contributing to company success.
VSA SA A U D SD VSD	60. Big business is responsible for maintaining the high level of employment that exists.

Circle One	
VSA SA A U D SD VSD	61. Most workers have jobs which are inconsequential and unmeaningful tasks beneath their ability.
VSA SA A U D SD VSD	62. Business statements are not much help in charting the progress of a company.
VSA SA A U D SD VSD	63. Business is characterized by lack of ethics.
VSA SA A U D SD VSD	64. Business should not worry about stable employment but should hire and fire as the need arises.
VSA SA A U D SD VSD	65. Skill and resourcefulness of management is mostly responsible for a business' degree of efficiency.
VSA SA A U D SD VSD	66. Business can stay ahead of a recession by using contracyclical pricing.
VSA SA A U D SD VSD	67. In successful companies, salesmanship is more important than satisfactory products.
VSA SA A U D SD VSD	68. When a recession occurs, no one group in the economy is to blame for causing it.
VSA SA A U D SD VSD	69. Competition should be preserved at all costs.
VSA SA A U D SD VSD	70. Management is more responsible for efficiency than mass production techniques and mechanization are.
VSA SA A U D SD VSD	71. People should shop the small outlets because the little fellow needs a break.
VSA SA A U D SD VSD	72. Community welfare, education and philanthropic endeavors are supported by business.
VSA SA A U D SD VSD	73. Most new products are not introduced by big firms.
VSA SA A U D SD VSD	74. "The Organization Man" is more real than fiction in American business.
VSA SA A U D SD VSD	75. The quality of a product is dependent on factors other than the size of the firm.
VSA SA A U D SD VSD	76. Poor management can sell a good product but good management cannot sell a poor product.
VSA SA A U D SD VSD	77. The 4½% rate of interest offered by banks is a fair rate of return for private investment.

Form III

This is a questionnaire designed to get at your ideas, opinions, and beliefs about business and its various aspects. Answer it as best you can as it relates to how you feel.

Do not neglect the rating task by grouping your answers at one end of the scale or in the middle. Try your best to discriminate those answers which best represent your feelings or beliefs for each item.

If the question of definition of terms arises, answer in terms of the way you would define the term.

The answer code is as follows:

VSA = Very Strongly Agree
SA = Strongly Agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree
VSD = Very Strongly Disagree

Circle that response for each item that best represents your attitude

Circle One	
VSA SA A U D SD VSD	1. Forecasting allows for the necessary flexibility needed in a dynamic business concern.
VSA SA A U D SD VSD	2. "Conscientious and principled" are terms that might well be applied to management.
VSA SA A U D SD VSD	3. The main goal of management should be a consistent set of operating policies.
VSA SA A U D SD VSD	4. The "little man" in business should be preserved and protected.
VSA SA A U D SD VSD	5. Labor unions should be as powerful as business management.
VSA SA A U D SD VSD	6. Price and quality directly effect profits.
VSA SA A U D SD VSD	7. The government should regulate the prices that business sets.
VSA SA A U D SD VSD	8. A business concern can usually get financial backing or borrow money, regardless of its position or condition.
VSA SA A U D SD VSD	9. It's more advantageous for Research and Development to work on new and better production processes than on product development.
VSA SA A U D SD VSD	10. Survival of the fittest should not be allowed to dominate the big vs. small business conflict.
VSA SA A U D SD VSD	11. Obtaining a larger share of the market is more important than obtaining a larger profit.
VSA SA A U D SD VSD	12. It is probable that the various functions of a business (production, finance, etc.) operate relatively independent of each other.
VSA SA A U D SD VSD	13. In a multiproduct firm, the wise manager chooses the products so the firm can compete at most or all of the various price levels in the market.
VSA SA A U D SD VSD	14. Most goods could be sold for less and still yield a fair profit.
VSA SA A U D SD VSD	15. Big business profits are not excessive.

Circle One	
VSA SA A U D SD VSD	16. What efficiency a large company has is mostly due to its larger amount of machinery, etc., rather than the skill of its management.
VSA SA A U D SD VSD	17. A large net profit margin is more important than a large share of the market.
VSA SA A U D SD VSD	18. A major job responsibility or management is to achieve a satisfactory return on capital invested.
VSA SA A U D SD VSD	19. "Big Business" is determined by the amount of profits earned.
VSA SA A U D SD VSD	20. Quality and mass production are inconsistent.
VSA SA A U D SD VSD	21. The bad things that happen because of monopoly outweigh the advantages of being able to produce more efficiently.
VSA SA A U D SD VSD	22. Business, as a rule, doesn't have the power to maintain high prices.
VSA SA A U D SD VSD	23. It is better for a firm to meet the costs of production by charging a high price than by maintaining production efficiency and lowering costs.
VSA SA A U D SD VSD	24. One of the advantages of using purchased parts in an assembly process is that you don't have to worry about inventory problems as is true with raw materials.
VSA SA A U D SD VSD	25. The unions negative propaganda against management has hurt the worker in the long run.
VSA SA A U D SD VSD	26. My personal views are similar to those of someone who is pro business.
VSA SA A U D SD VSD	27. The disadvantageous social effects of business concentration outweigh the beneficial effects of optimum efficiency.
VSA SA A U D SD VSD	28. Business management is impersonal and distant.
VSA SA A U D SD VSD	29. Management's belief is that the labor force is always trying to do the minimum rather than the maximum.

Circle One	
VSA SA A U D SD VSD	30. Because expenses decrease with volume it is generally wise to aim for a higher volume of sales at a lower unit price.
VSA SA A U D SD VSD	31. A highly-structured management hierarchy is more resistant to change than a committee-type management.
VSA SA A U D SD VSD	32. A good indication of the effectiveness of a company's management is seen in the fluctuations of its stock price in the market.
VSA SA A U D SD VSD	33. It is usually possible to tell pretty closely what the effects of money spent on advertising are.
VSA SA A U D SD VSD	34. Management tends to exploit labor and not pay them their worth.
VSA SA A U D SD VSD	35. The job of management is to impress people with the fact that profits are good for employees.
VSA SA A U D SD VSD	36. Businessmen are concerned with job security for their workers when they established plans and policy.
VSA SA A U D SD VSD	37. Effective management is the same as shrewd management.
VSA SA A U D SD VSD	38. An executive who controls all of the decisions will be more successful than one who confers with his staff.
VSA SA A U D SD VSD	39. Most businesses receive more than a fair rate of return.
VSA SA A U D SD VSD	40. Business should have more control over what goes on in this country.
VSA SA A U D SD VSD	41. Large corporations have too much power.
VSA SA A U D SD VSD	42. The bad effects of big business activity outweigh the good effects.
VSA SA A U D SD VSD	43. Management exerts a constant pressure to get rid of or replace labor through mechanization and method changes.
VSA SA A U D SD VSD	44. In determining optimum size, maintaining competition should be considered before obtaining maximum efficiency.

Circle One	
VSA SA A U D SD VSD	45. Forecasting future sales is the most important part of business planning.
VSA SA A U D SD VSD	46. The error in forecasted estimates is fairly constant regardless of the length of time being considered.
VSA SA A U D SD VSD	47. Managers generally encourage the workers to get involved in their jobs and arrange the work load so that the workers are not rushed.
VSA SA A U D SD VSD	48. Most of the advantages, benefits, and privileges which have accrued to employees are a result of competition or union pressure rather than an enlightened management.
VSA SA A U D SD VSD	49. Business should be regulated by the government.
VSA SA A U D SD VSD	50. When planning production volume changes, one of the most important considerations is inventory planning.
VSA SA A U D SD VSD	51. Business does not carry its share of the tax load.
VSA SA A U D SD VSD	52. Big business has been mainly responsible for new product innovation.
VSA SA A U D SD VSD	53. Businesses usually produce efficiently; that is, at or near capacity.
VSA SA A U D SD VSD	54. Generally speaking, management considers labor as expendable.
VSA SA A U D SD VSD	55. The growth of large business units is due to situational factors rather than to productive qualities.
VSA SA A U D SD VSD	56. Specialization of the labor force is a desired end.
VSA SA A U D SD VSD	57. Labor is more motivated by money than management is.
VSA SA A U D SD VSD	58. Profit is viewed by management as being more important than good labor relations.
VSA SA A U D SD VSD	59. Excessive hiring and firing of men during the same time period should be avoided by management even different labor skills may be needed.

Circle One

VSA SA A U D SD VSD 60. The more changes a production manager can incorporate into his production line, the more efficient it will be.

VSA SA A U D SD VSD 61. Most workers have jobs which are inconsequential and unmeaningful tasks beneath their ability.

VSA SA A U D SD VSD 62. Business statements are not much help in charting the progress of a company.

VSA SA A U D SD VSD 63. Business is characterized by lack of ethics.

VSA SA A U D SD VSD 64. Business should not worry about stable employment but should hire and fire as the need arises.

VSA SA A U D SD VSD 65. Skill and resourcefulness of management is mostly responsible for a business' degree of efficiency.

VSA SA A U D SD VSD 66. Business can stay ahead of a recession be using contracyclical pricing.

VSA SA A U D SD VSD 67. It is sometimes profitable to build in overcapacity in plant expansion plans.

VSA SA A U D SD VSD 68. A company's cash flow position can be in its poorest condition when sales revenue is highest.

VSA SA A U D SD VSD 69. A company may find itself needing a very costly cash loan when it is making the most profit.

VSA SA A U D SD VSD 70. Management is more responsible for efficiency than mass production techniques and mechanization are.

VSA SA A U D SD VSD 71. It is just as important to plan inventories so they won't be in excess as it is necessary to insure a sufficient supply.

VSA SA A U D SD VSD 72. Organization has a way of forcing itself into business activity even if it is resisted.

VSA SA A U D SD VSD 73. Most new products are not introduced by big firms.

VSA SA A U D SD VSD 74. "The Organization Man" is more real than fiction in American business.

Circle One

VSA SA A U
D SD VSD
75. Managers are usually forced to specialize because of the demands of the various functions of a business.

VSA SA A U
D SD VSD
76. Poor management can sell a good product but good management cannot sell a poor product.

VSA SA A U
D SD VSD
77. The demands made on a production manager by the problems of his particular function dictate that he will operate independently of other managers.

Form IV

True-False

1. Recapitalization by converting stocks into bonds may reduce the cost of capital through interest deductions.

2. Generally it is more efficient for a company to manufacture all of the parts it uses in its process rather than buy from an outside source.

3. Any measure taken to reduce seasonable production variance will generally be profitable.

4. Forecasts of sales volume is as helpful to production as it is to the sales department.

5. A manufacturer should not concentrate on his most profitable line.

6. It can be wise to reduce the variety of products that a company markets.

7. The job of advertising is to help in the selling job.

8. Personal selling is a better method than advertising.

9. It is as important to sell the salesman on the job of selling as it is for him to sell the product.

10. Liquid working capital is the lifeblood of a going concern.

11. Poor employee relations is the only reason for high turnover of employees.

12. Stabilizing employment helps the company's reputation in the labor market.

13. Money is generally more important to the workers than stable employment.

14. New workers should be segregated from the old workers wherever possible.

15. All capital requirement plans because of their emphasis on the future are long-run plans.

16. Working and fixed capital requirements determine the cash budget for the ensuing year.

True-False

17. Capital budgeting has nothing to do with marketing.

18. All budgets should have "fudge factor" for error.

19. Financial planning is linear, as opposed to cyclical.

20. Minimum working capital can be found by subtracting current liabilities from current assets at the time of the greatest investment in inventories and accounts receivable.

21. All working capital should result from operations.

22. It is possible to increase working capital by speeding up accounts receivable and sales.

23. A shorter period of production will increase the need for working capital.

24. When working capital gets scarce, it helps to stockpile inventory to increase the current assets.

25. A company should constantly watch for the opportunity to convert inactive assets to cash.

26. If stock is watered through overcapitalization, it will sell above par in the market place.

27. The purpose of an accounting system should be to aid in planning, organizing, coordinating and controlling.

28. Cost systems usually do not include labor costs.

29. Unit manufacturing cost is a good basis for setting the price level.

30. Business forecasts cannot anticipate seasonal or cyclical changes.

31. It is necessary to forecast if a company wants to liquidate its inventories before a business slowdown.

32. It is fairly easy to expand inventories and capacity in the early stages of recovery without the use of forecasting.

33. Forecasting shows that increased retail sales are usually followed by added employment.

34. Business indicators and indexes cannot forecast a turn in the economy with any degree of accuracy.

True-False

35. Interest rates--the cost of borrowing money, indicate people's aspirations of the future economy.

36. In forecasting sales, the turnover of bank deposits measures the use of credit.

37. All business cycles have a crisis: a sharp drop in business, prices and employment.

38. Most business cycles follow a regular pattern.

39. The crucial things to watch in forecasting are the initiating causes of business cycles.

40. Government spending has a very large effect on the business cycle.

41. The effect of a tax cut operates much like government spending.

42. Cyclical movements in other countries can largely be ignored in terms of their effect on the United States economy.

43. Forecasts are never more than probable courses of events.

44. The new elements in the economy that will affect expected results can often be measured quite adequately.

45. In times of prosperity, a company should be looking for the time to cut inventories back.

46. A company should look ahead to the time when it should buy in lower volume and perhaps start to drop prices even in prosperity.

47. As long as demand exceeds capacity and the economy in general is booming, a company should expand to meet the demand.

48. Forecasting should see to it that a price rise precedes the move from the depression to recovery stages of the business cycle.

49. Production should be geared closer to forecasts than to sales.

50. A budget is the financial shadow of a plan.

51. The cash flow budget should be the first budget on the agenda.

52. Budgets for manpower, materials and resources are just as important as money requirements.

True-False

53. A budget is used more to control the present than to anticipate the future.

54. Each firm should approach its future goals irrespective of the goals of other firms.

55. If a depression or recession is imminent, it is best to put off the purchase of needed plant and equipment until it arrives and purchase during the depression.

56. Economics describes and explains all the institutions and activities by which mankind provides for its wants.

57. The utility of an object is determined by its price.

58. Goodwill could not be considered wealth because it is not material.

59. Market value of a stock minus the par value equals the book value.

60. A company's assets may be less than its liabilities and it may still be solvent.

61. Value is based on exchange.

62. A buyer and seller have a conflict of interests and something in common at the same time.

63. In a free auction in which the article is always sold regardless of price, competition does not enter the transaction.

64. The seller quotes the price in all business transactions.

65. Demand is always relevant to a particular market and a certain time.

66. Demand and desire are the same thing.

67. Supply is the same thing as the stock of that good on hand.

68. Supply and Demand vary directly with price.

69. Prices are fixed by Supply and Demand.

70. If Demand at a given price is greater than the Supply, the price will rise.

71. An increase in supply increases the price and decreases the quantity exchanged.

True-False

72. The law of demand does not hold for a product like salt because demand is inelastic and more will not be bought as the price decreases.

73. Elasticity refers to the degree of responsiveness of quantity to price.

74. Elasticity is reflected by the effect on total revenue of a price change.

75. If a producer wants to raise his price, an elastic demand curve for his product will hurt him.

76. A price war in an industry characterized by inelastic demand will benefit most of the competitors.

77. A producer claims his product has an inelastic demand curve. He lowered his price and total revenue decreased. This is consistent with his statement.

78. In an elastic demand situation, total revenue increases as prices are raised.

79. Unitary elasticity is the situation where the quantity sold does not vary as the price changes.

80. Where an inelastic demand exists, there is danger of competitors pricing themselves out of the market, but not if there is elastic demand.

81. If demand is inelastic, a price increase will increase the quantity sold.

82. A multitude of substitutes makes for a decrease in quantity sold with a price increase and hence an inelastic demand.

83. If a product is very elastic, a decrease in price will cause many people to switch to it from other similar products.

84. The demand for gasoline is inelastic because there are so many substitutes (i.e., competing brands) for it.

85. Most product demand curves are both elastic and inelastic at different points along the curve.

86. Cross elasticity refers to the effect on A's demand of B's price.

87. Inelastic is to necessity as elastic is to luxury.

True-False

88. If a competitor drops his price and loses sales dollars, chances are good (assuming equal starting points) that you would benefit by raising yours.

89. If a small change in price brings a more than proportional change in the quantity offered for sale, the supply is relatively inelastic.

90. Distributors or middlemen should be thought of as physical handlers rather than salesmen.

91. The amount of money spent in the market place rises proportionately with increases in total wages paid.

92. Low cost is always the determining consideration in choosing between alternate methods of transportation.

93. Middlemen are used because they can get the necessary or desired distribution more effectively than alternative methods.

94. Where speed is important, a manufacturer generally works through wholesalers to get faster distribution.

95. Most industrial goods are sold direct to user.

→ 96. An important function of the retailer in a long distribution channel is breaking bulk.

97. A manufacturer doesn't need salesmen if he markets through wholesalers.

98. Advertising is the most effective means of sales promotion.

99. Advertising cannot reduce the number of customers leaving a particular brand.

100. Most of advertising is focused on retaining present customers rather than recruiting new ones.

101. Advertising does nothing to decrease unit cost of a good.

102. Advertising really has no value because it merely transfers purchasing power from A to B.

103. Advertising will increase the demand for any product.

104. The effects of advertising are generally known rather precisely.

True-False

105. The point of diminishing returns from advertising does not come until the market is fully saturated with your product.

106. Advertising seldom pays because it adds more to the cost of the good than it increases revenue.

107. The best policy to use in advertising is consistency rather than emphasizing major promotions.

108. After a product has been advertised for a long time, the advertising can sometimes be cut back with little effect on sales.

109. Advertising is important in establishing product differentiation.

110. Research has a dual effect on costs, both working to reduce unit cost.

111. Through good research, a product can be made for less and sold for more.

112. The amount of research a company does has a direct relationship to the price of the product.

113. Research should be a continuous function rather than something that is done for new product introductions.

CHAPTER IV

AN EVALUATION OF A SIMPLE MANAGEMENT GAME IN AN UNDERGRADUATE COURSE

by

H. E. Thompson and R. W. Hansen

PART I

A. Introduction

Since their introduction in the late 1950's, management games have generated an ever-increasing concern on the part of business educators. Both the construction and use of management games range over a wide spectrum. Games exist from the very complex computer calculated games such as Carnegie Tech's[1] to simple hand-computed games such as Andlinger's.[2] They are used in colleges and universities for graduate, undergraduate, and adult programs as well as in many industrial and commercial firms. In each one of these uses the game is intended to serve as a vehicle for one or more of the following: 1) the transmission of facts and concepts, 2) a laboratory for simulated decision experience, 3) an instrument to motivate participants and 4) affect attitude of participants.

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[1] Andlinger, G. R., "Business Games--Play One!" Harvard Business Review, July-August 1958, 147-52.

[2] Cohen, K. J., W. R. Dill, A. A. Kuehn, P. R. Winters, The Carnegie Tech Management Game, Richard D. Irwin, 1964.

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Accompanying the development of games has been a concern as to their effectiveness and efficiency as a pedagogical technique. The evidence presented at the Tulane Conference on Business Games as Teaching Devices in 1961 is summed up in the following comment by the editors of the proceedings:

"Although a few relatively formal evaluation attempts are reported upon in the individual discussion papers, most of the present support for gaming consists of intuitive judgments with little or no basis in scientifically objective evidence."[3]

Since the Tulane Conference, McKenney has published an evaluation of the UCLA Executive Decision Game No. 3 used in a course in the M. B. A. program at Harvard.[4] Dill and Doppelt[5] have analysed student responses pertaining to the types of learning gained from playing the Carnegie Tech management game.

The evaluation which follows, in contrast with the two analyses cited above, is based on a relatively simple game. The rationale for such an examination follows from two basic ideas. Certainly because of the expense of both developing and running management games, the simple game should not be ruled out. In the second place, when a game is used in an introductory undergraduate course, there is a real question as to the degree of complexity which should be introduced.

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[3] Dill, W. R., J. R. Jackson, J. W. Sweeney (Eds.), Proceedings of the Conference on Business Games, Tulane University, 1961, p. 13.

[4] McKenney, J. L., "An Evaluation of a Business Game in an MBA Curriculum," Journal of Business, July 1962, 278-286.

[5] Dill, W. R. and N. Doppelt, "The Acquisition of Experience in a Complex Management Game," Management Science, October 1963, 30-46.

In order to evaluate the effect of a management game in this as in any situation, it is necessary to determine a set of plausible tentative hypotheses indicating the possible effects of a game. The hypotheses which we have formulated are quite similar to those set forth by Robinson.[6] They are explicitly stated in the next section.

B. The Hypotheses, the Game, and the Experiments

Each hypothesis represents a neutral statement about a possible contribution of a management game. They are thus a set of null hypotheses. These hypotheses, formulated in operational terms, are:

1) Students who participate in a management game acquire no better knowledge of facts or understanding of concepts than those who do not participate.
2) Student's attitudes toward management and business are not changed by management game play.
3) Students who participate in a management game do not become more highly motivated in their study than those who do not participate.

We have not formulated a fourth hypothesis relating to simulated business experience since it is beyond the scope of this study.

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[6] Johnston, J., Econometric Method, McGraw-Hill, 1963.

In order to test these typotheses a simple general management game--developed by one of the authors--was introduced as an adjunct to an introductory course in marketing methods. It was felt that this general management game was appropriate for two reasons. First, marketing decisions must be made in the total operating environment of the firm. In the second place the game included more decision variables from marketing than any other functional area. A complete description of the game can be found in reference.[7]

The experiment was first attempted in the fall of 1964. The class consisted of 171 students, 102 of whom participated in 18 games. Of those who participated, 27 played alone, 24 with another person, 27 with two other persons, and 24 with three other persons. The games were started in the middle of the semester and continued at two plays a week for four weeks. Before and after the game each student in the class was given an attitude questionnaire,[8] and a test designed to measure their knowledge of facts and understanding of concepts. In addition each student was asked to keep a log of the time spent on various parts of the course, both before game play, during game play, and after game play. This log produced time estimates which were highly questionable and was subsequently dropped for the replication.

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[7] Thompson, Howard E., and LeRoy J. Krajewski, A Simple Management Game: Structural Equations and Computing Procedures. Mimeographed, 1965.

[8] Johnson, A. C. and D. Lamers, "Management Games and Student Attitudes," Unpublished June 1, 1965.

The experiment was replicated in the spring of 1965. This second class consisted of 160 students, 88 of who particpated in 18 games. The distribution between 1, 2, 3, and 4 person teams was roughly even. The attitude questionnaire was again given before and after game play. A revised fact and concept examination was given and the log of student time was dropped in favor of an instrument which was designed to allow participants to express the intensity of their feelings toward the game.

The data related to the first two hypotheses from these experiments were analyzed by regression methods. These methods were selected for two reasons. First, the class was most conveniently divided by discussion sections rather than by random sampling. In the second place we felt that a number of independent variables must be included simultaneously in any analysis of the data. The methodology will be explained in the next section.

C. Statistical Methodology

For each student there exists a number of possible measures of the effectiveness of the game. In our study the following were used:

1. y_1 -- Final examination score
2. y_2 -- Post-game minus pre-game fact and concept attainment score
3. y_3 -- Post-game minus pre-game attitude toward management score
4. y_4 -- Post-game minus pre-game attitude toward business score
5. y_5 -- Post-game minus pre-game attitude toward game relationships score

These measures of effectiveness depend on variables of a personal nature as well as those variables relating to the game. The variables chosen for our analysis are:

1. V_1 -- The six-weeks examination grade
2. V_2 -- Major field of study
3. V_3 -- Game participation
4. V_4 -- Number of members in a firm for those who participated

The dependent variables were related to the measures of effectiveness using multiple regression techniques. Since some of the variables were not measured on a numerical scale the dummy variable technique was used.[9] The six-weeks examination grade was used in all cases as a proxy for the multitude of variables related to the student's success in college.

The particular regressions which were run are described below with reference to the independent variables.

Regression	Dependent Variable	Independent Variables
1.	y_1	V_1, V_3
2.	y_2	V_1 V_3
3.	y_3	V_1, V_3
4.	y_4	V_1, V_3
5.	y_5	V_1, V_3

(Continued on next page)

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[9] Op. cit., Johnston.

Regression	Dependent Variable	Independent Variables
6.	y_1	V_1, V_2, V_3
7.	y_2	V_1, V_2, V_3
8.	y_3	V_1, V_2, V_3
9.	y_4	V_1, V_2, V_3
10.	y_5	V_1, V_2, V_3
11.	y_1	V_1, V_3, V_4
12.	y_2	V_1, V_3, V_4
13.	y_3	V_1, V_3, V_4
14.	y_4	V_1, V_3, V_4
15.	y_5	V_1, V_3, V_4

1. Detailed Description of Regressions 1-5

The measure of effectiveness $y_i (i=1, \ldots, 5)$ is assumed to have the following form

$$y_i = as_1 + b_1 z_1 + b_2 z_2 + \epsilon$$

where x_1 is a measure of Variable V_1, the six-weeks examination score, and

$$z_1 = \begin{cases} 1 \text{ if the student participated in the game} \\ 0 \text{ if the student did not participate} \end{cases}$$

and

$$z_2 = \begin{cases} 0 \text{ if the student participated in the game} \\ 1 \text{ if the student did not participate} \end{cases}$$

The term ϵ is the residual and carries the usual regression assumptions. The mean measure of effectiveness for those who participated is then

$$y_i^P=\hat{a}x_1+\hat{b}_1$$

and the mean measure of effectiveness for those who did not is

$$y_i^{\bar{P}}=\hat{a}x_1+\hat{b}_2$$

where $\hat{a}$ and $\hat{b}_1$, $\hat{b}_2$ are the estimated regression coefficients.

The difference between those who participated and those who did not is then

$$y_i^P-y_i^{\bar{P}}=\hat{b}_1-\hat{b}_2.$$

A standard "t" test can then be applied to test the significance of this difference. Thus $(\hat{b}_1-\hat{b}_2)/S_{\hat{b}_1-\hat{b}_2}=(\hat{b}_1-\hat{b}_2)/\sqrt{S^2_{\hat{b}_1}+S^2_{\hat{b}_2}-\text{cov}(\hat{b}_1, \hat{b}_2)}$ has a "t" distribution with n-3 degrees of freedom.

2. Detailed Description of Regressions 6-10

Regressions 6-10 add an additional variable, the major field of study, to the analysis. Since the major field of study was divided into two categories--marketing and nonmarketing majors--there are, in all, four possible combinations and hence four dummy variables.

The regression equation is

$$y_i=ax_1+b_1z_1+b_2z_2+b_3+z_3+b_4+z_4+\epsilon$$

where x_1 and have the same meaning as the previous problem but the z_i's are defined in the following way:

Major	Participation	z_1	z_2	z_3	z_4
Marketing	yes	1	0	0	0
Marketing	no	0	1	0	0
Nonmarketing	yes	0	0	1	0
Nonmarketing	no	0	0	0	1

The differential effects of the game are computed in a similar manner to those in Section A.

3. Detailed Description of Regressions 11-15

Regressions 11-15 are concerned with the number of participants in a firm. The experiment was set up to include 0, 1, 2, 3, or 4 participants on each team (0 being a nonparticipant). Thus we can express the measure of effectiveness as

$$y_i=ax_1+b_1z_1+b_2z_2+b_3z_3+b_4z_4+b_5z_5+\epsilon$$

where x_1 and ϵ are defined as in the previous case and the z_i's are defined as

Number of Participants	z_1	z_2	z_3	z_4	z_5
0	1	0	0	0	0
1	0	1	0	0	0
2	0	0	1	0	0
3	0	0	0	1	0
4	0	0	0	0	1

D. The Results and Discussion

Tables I-VII contain the results from the fall semester of 1964. Tables IR-VIIR contain the results from the spring semester of 1965. It can be very clearly noted that not a single effect is significant in both the original experiment and the replication. Since y_1, y_2 and y_5 represent ways of looking at Hypothesis (1) we have no basis for rejecting the hypothesis. Since y_3 and y_4 represent ways of looking at Hypothesis (2) we have no basis for rejecting it.

Our attempts at testing Hypothesis (3) were unsuccessful. The time log used the first semester did not work. During the second semester only those who participated in the game were polled. On the whole, they felt that more class time should be devoted to the game. They were, however, undecided as to the value of spending time on the game in lieu of spending it on course readings.

Of course one cannot proceed to declare management games of no consequence based on these experiments. Among the possible explanations of the results could be the following: (a) using the game strictly as an adjunct has no effect, (b) the particular game used was not appropriate and hence no effect was detected, (c) other game effects, which were not measured, exist, (d) the instruments of measurement were not sufficiently accurate to detect differences.

Rather than embark on a set of full-scale experiments which would be required to study the first three explanations we propose to look more carefully at the fourth explanation.

Both the attitude questionnaire (which accounts for y_3, y_4, y_5) and the fact and concept test (which accounts for y_2) are scored on the basis of aggregates of individual questions. In the attitude questionnaire a weight from 1 to 7 may be assigned to each question depending on the student response whereas in the fact and concept score each individual question is given a weight of one. To assess the possible undesirable effects of the aggregation we proceed now to an analysis of individual items.

Table I

Differential Effect of the Game:

Participation vs. Nonparticipation

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_1-\hat{b}_2$	.37	.01	.97	-2.16	.65
Significance Test $(\hat{b}_1-\hat{b}_2)/S_{\hat{b}_1-\hat{b}_2}$	.11	.01	.69	1.39	.44

Table IR

Differential Effect of the Game:

Participation vs. Nonparticipation

(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential effect $\hat{b}_1-\hat{b}_2$	-.57	.61	-1.19	-.24	.62
Significance Test $(\hat{b}_1-\hat{b}_2)/S_{\hat{b}_1-\hat{b}_2}$	.13	.72	1.00	.18	.66

Table II

Differential Effect of the Game:

Marketing Majors

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_1-\hat{b}_2$	-.93	-.27	-4.08	-7.94	.69
Significance Test $(\hat{b}_1-\hat{b}_2)/s_{\hat{b}_1-\hat{b}_2}$	1.84*	.16	1.27	2.25	.28

Table IIR

Differential Effect of the Game:

Marketing Majors

(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_1-\hat{b}_2$	-6.93	-4.08	.66	-4.03	3.23
Significance Test $(\hat{b}_1-\hat{b}_2)/s_{\hat{b}_1-\hat{b}_2}$	.54	1.38	.18	.96	1.18

Table III

Differential Effect of the Game:

Nonmarketing Majors

	On Variables				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_3-\hat{b}_4$	.68	.72	2.18	-1.28	-.09
Significance Test $(\hat{b}_3-\hat{b}_4)/s_{\hat{b}_3-\hat{b}_4}$	.27	.02	1.26	.69	.07

Table IIIR

Differential Effect of the Game:

Nonmarketing Majors
(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_3-\hat{b}_4$	1.55	.96	1.43	.52	.37
Significance Test $(\hat{b}_3-\hat{b}_4)/s_{\hat{b}_3-\hat{b}_4}$	.35	.98	--	.27	.36

Table IV

Differential Effect of the Game:

1 Player Firm vs. Nonparticipation

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_2-\hat{b}_1$	.68	.15	1.20	-1.90	2.58
Significance Test $(\hat{b}_2-\hat{b}_1)/S_{\hat{b}_2-\hat{b}_1}$	.20	.13	.61	.84	1.69*

Table IVR

Differential Effect of the Game:

1 Player Firm vs. Nonparticipation
(Replication

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_2-\hat{b}_1$	.64	.86	.36	2.63	-.11
Significance Test $(\hat{b}_2-\hat{b}_1)/S_{\hat{b}_2-\hat{b}_1}$	.10	.61	.20	1.38	.07

Table V

Differential Effect of the Game:
2 Player Firm vs. Nonparticipation

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_3-\hat{b}_1$	-1.03	-2.58	1.71	-2.98	-.12
Significance Test $(\hat{b}_3-\hat{b}_1)/s_{\hat{b}_3-\hat{b}_1}$	.26	2.30*	.87	.12	.08

Table VR

Differential Effect of the Game:
2 Player Firm vs. Nonparticipation
(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_3-\hat{b}_1$	-5.69	-.13	-2.29	-2.96	-.62
Significance Test $(\hat{b}_3-\hat{b}_1)/s_{\hat{b}_3-\hat{b}_1}$	.83	.17	1.12	1.37	.39

Table VI

Differential Effect of the Game:

3 Player Firm vs. Nonparticipation

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_4-\hat{b}_1$	3.05	1.61	1.20	-1.12	1.19
Significance Test $(\hat{b}_4-\hat{b}_1)/S_{\hat{b}_4-\hat{b}_1}$	.85	1.59	.61	.51	.79

Table VIR

Differential Effect of the Game:

3 Player Firm vs. Nonparticipation
(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_5-\hat{b}_1$	-4.21	-.15	-2.11	-1.63	.94
Significance Test $(\hat{b}_5-\hat{b}_1)/S_{\hat{b}_5-\hat{b}_1}$	.68	.10	1.18	.87	.67

Table VII

Differential Effect of the Game:

4 Player Firm vs. Nonparticipation

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_5-\hat{b}_1$	-.68	.19	1.33	-1.53	1.67
Significance Test $(\hat{b}_5-\hat{b}_1)/S_{\hat{b}_5-\hat{b}_1}$	.15	.14	.57	.55	.90

Table VIIR

Differential Effect of the Game:

4 Player Firm vs. Nonparticipation
(Replication)

	On Variable				
	y_1	y_2	y_3	y_4	y_5
Differential Effect $\hat{b}_5-\hat{b}_1$	10.03	2.41	1.13	1.94	.50
Significance Test $(\hat{b}_5-\hat{b}_1)/S_{\hat{b}_5-\hat{b}_1}$	1.45	.46	.49	.79	.28

Part 2

A. Introduction

In Part 1 of this study we examined aggregate measures from which are detected no effects of the game on the understanding of facts and concepts or attitudes. Thus we could not reject the hypotheses which we had formulated. By turning now to an item analysis, we can gain some insight into the possible effects of the game.

Since our intended purpose for this part of the study is to gain insights, it will consist of a combination of reported results and our speculations as to the reasons for these results.

B. Item Analysis of Test Results

Attitude questionnaire. In the attitude questionnaire the student is given a statement about which he must state the strength of his agreement as one of the following seven categories: very strongly agree, strongly agree, agree, uncertain, disagree, strongly disagree, and very strongly disagree. The questionnaire consisted of 77 statements each of which could be assigned to at least one aggregate measure: attitude toward business, attitude toward management, and attitude toward game relationships.

Of the 77 statements, attitudes on only three seemed to be affected significantly by game play. It is, then, easy to see why there was no measurable aggregate effects.

It is well worthwhile to examine in more detail the three statements about which attitudes differed. They are:

S 11. "Obtaining a larger share of the market is more important than obtaining a larger profit."

S 36. "Businessmen are concerned with job security for their workers when they establish plans and policy."

S 39. "Most businesses receive more than a fair rate of return."

From Table VIII we can conclude that although the majority of students disagree with statement S 11, there is a greater tendency for game participants to disagree than nongame participants. It appears from this question that the game has emphasized an important business concept--the role of profits.

When we look at the next two statements, however, we get a different point of view. The statistics from the analysis of S 36 show rather surprising results. There is a greater tendency for game participants to agree while there is a greater tendency for nongame participants to be more uncertain. The result is surprising because the game used has no explicit manpower decision variables. As a possible explanation for this result we may hypothesize that because game players must be concerned with finance, marketing, and production in making plans that they extrapolate to include the employee and his job!

Finally the results of S 39 show less uncertainty for those who play the game than those who do not. Game players, through their experience, form more definite attitudes toward "fairness" of rate of return than nongame players. If this result is common, it represents a potential danger in the use of management games. If games by providing a small amount of psuedo-experience in business lead the student to "jump to conclusions" they can indeed be harmful.

Table VIII

Post Game Attitude Questionnaire:

Statements for Which the Responses Were Significantly Different

		Fraction Disagreeing	Fraction Uncertain	Fraction Agreeing	N
Q 11	Game	.738	.127	.132	173
	Nongame	.609	.145	.242	131
	Diff	.129	-.017	-.110	
	t	2.38	-.45	-2.04	
Q 36	Game	.218	.052	.726	173
	Nongame	.303	.137	.545	131
	Diff	-.085	-.085	.181	
	t	-1.68	-2.59	3.31	
Q 39	Game	.565	.190	.241	173
	Nongame	.464	.297	.235	131
	Diff	.101	-.106	.006	
	t	1.75	-2.17	.12	

We have now been able to conclude that the reason there were no significant effects on the aggregate scores was because there were very few significant effects on individual questions. From an analysis of pre-test and post-test responses to individual questions it was found that there were eleven significant changes among nonparticipants. Therefore we can conclude that the test instrument does measure some changes in attitude and that the game affects attitudes only slightly.

Fact and concept test. A revised test designed to measure the student's knowledge of facts and understanding of concepts was also given to all students before and after game play during the second semester. This test consisted of 113 statements judged by the student to be either correct or incorrect. There were six questions where significant differences were noted on the post test. They were:

Q 1. Recapitalization by converting stocks into bonds may reduce the cost of capital through interest deductions.

Q 5. A manufacturer should not concentrate on his most profitable line.

Q 21. All working capital should result from operations.

Q 29. Unit manufacturing cost is a good basis for setting the price level.

Q 86. Cross elasticity refers to the effect on A's demand of B's prices.

Q 90. Distributors or middlemen should be thought of as physical handlers rather than salesmen.

The statistics concerning these statements appear in Table IX. Again it will be worthwhile to examine the individual statements for possible explanations of the results.

Questions 86 and 90 can be explained by the instructions for game play in conjunction with play itself. In the participant's manual the statement "a degree of cross-elasticity between participants does exist" appears. Therefore one might expect that a student who read the manual and subsequently played the game would be more cognizant of the meaning of the term. Similarly a statement characterizing the distributor as a salesman also exists in the participant's manual. It is "the distributor puts out sales effort in proportion to the amount of business he is sent." This goes a long way toward explaining the propensity of game players to think of the distributor as something more than a physical handler.

The remaining questions do not have explanations which are as evident. Interpreting the results in one possible way leads to an unfavorable interpretation of the effect of the game. The game was a relatively simple one with a single product, no distinction between debt and equity capital, and short term loans made only when cash shortages arose. Therefore, one might suggest that the answers to Q 1, Q 5, and Q 21 were a result of an oversimplified look at business management.

The statistics on Q 29, may be the result of a different interpretation put on the question because of game play. Participants in the game were given, as a part of their output, the unit manufacturing cost. They

Table IX

Post Game Fact and Concept Test:

Questions for Which Responses Were Significantly Different

		Fraction Answering True	N
Q 1	Game	.556	88
	Nongame	.722	72
	Diff	-.165	
	t	-2.15	
Q 5	Game	.159	88
	Nongame	.319	72
	Diff	-.160	
	t	-2.39	
Q 21	Game	.272	88
	Nongame	.138	72
	Diff	.133	
	t	2.05	
Q 29	Game	.647	88
	Nongame	.486	72
	Diff	.161	
	t	2.05	
Q 86	Game	.954	88
	Nongame	.835	72
	Diff	.118	
	t	2.48	
Q 90	Game	.356	88
	Nongame	.534	72
	Diff	-.177	
	t	-2.25	

quickly learned that the selling price must be high enough to cover not only the unit manufacturing cost but also the "operating expenses." Therefore, we might interpret their response as meaning that unit manufacturing is a lower limit to price. Nongame players would interpret the statement from a "market" point of view.

From the analysis of the difference between pretest and post test scores we find eighteen significant changes. Therefore, we can conclude from this item analysis of the fact and concept scores that the test did measure some changes and the game itself provided a small fraction of the change.

C. Summary and Conclusions

We have attempted to evaluate the effectiveness and the efficiency of a simple management game in an undergraduate course. Our evaluation has been built around the following three tentative hypotheses:

1) Students who participate in a management game acquire no better knowledge of facts or understanding of concepts than those who do not participate.
2) Student's attitudes toward management and business are not changed by management game play.
3) Students who participate in a management game do not become more highly motivated in their study than those who do not participate.

A test instrument designed to measure knowledge of facts and concepts yielded results which were insufficient, in aggregate to reject Hypothesis (1).

Upon item analysis of the test instrument we did detect a small number of cases where significant differences could be found. These cases represent positive as well as unintended results. Thus, it is our feeling that there was not enough evidence to reject Hypothesis (1).

Aggregate measures of attitudes toward management and business were found insufficient to reject Hypothesis (2). However, there were significant attitude changes when we examined individual items. These changes were so few in number that they do not add much weight in an attempt to reject the hypothesis.

With reference to Hypothesis (3) we were not successful in detecting any "increased motivation" as the result of the game. We did note, however, that on the whole the students felt the game was realistic, not too simple, and that not enough class time was spent on the game. We also found the game players were equally divided on whatever time spent on the game was better spent than on readings.

From our results we are forced to conclude that using a simple management game as an adjunct to an undergraduate course is not an effective way to transmit facts and concepts or to change attitudes. The game appeared to reflect an oversimplified view of reality and because of this,caused the students to respond from a narrow point of reference.

The game did, however, produce some positive results. Certain facts and concepts were effectively transmitted and certain attitudes were apparently changed because of game play. The role of profits was a case in point. However, the efficiency of this transmission is the crucial issue. Since the student's time is a scarce resource and since computer time is costly we feel that these points which were successfully reinforced by game play could have been accomplished in other, more efficient ways.

Our conclusions are, of course, drawn from the use of a very simple game in an undergraduate course. Since many games which are at least as simple are used as an adjunct in business courses we feel that such uses merit some additional reflection. It may be that a more "complex and realistic" game would produce results which are quite different. One would assume, however, that a game which is "too" complex would be equally ineffective and even less efficient. Therefore, the most effective game is likely to be somewhere between the simple and complex.

CHAPTER V

AN EVALUATION OF A COMPLEX MANAGEMENT GAME WITH UNDERGRADUATES

by

Howard E. Thompson

A. Introduction

In order to evaluate the use of a complex management game with undergraduate faculty members at the Wisconsin State Universities each were asked to provide two teams of four players and a control group of eight students with similar backgrounds who would not participate in the game. Each of these groups--participants and non-participants--were administered the attitude questionnaire and the fact and concept test in the fall of 1965 before game play and in the spring of 1966 after game play.

All contact with the faculty members at the State Universities were done by mail or by phone. Thus individual administration of the game in each State University varied with the wishes of the faculty members involved. Any class assignments made in conjunction with the game were the complete responsibility of the Universities themselves and hence no "open ended" feedback was provided. The attitude and fact and concept tests were the only communication with both the participants and non-participants.

B. The Attitude Questionnaire

The results of giving the attitude questionnaire to 38 game participants and 31 non-participants at the completion of game play yielded nine significant differences. This was, of course, more than the number which resulted from the application of the simple game to undergraduates. A closer look at the individual statements is in order.

The following are the statements on which significant differences in responses were found:

S 20 Quality and mass production are inconsistent.

S 24 One of the advantages of using purchased parts in an assembly process is that you don't have to worry about inventory problems as is true with raw materials.

S 25 The Union's negative propaganda against management has hurt the workers in the long run.

S 30 Because expenses decrease with volume it is generally wise to aim for a higher volume of sales at a lower unit price.

S 32 A good indication of the effectiveness of a company's management is seen in the fluctuations of its stock price in the market.

S 44 In determining optimum size, maintaining competition should be considered before obtaining maximum efficiency.

S 51 Business does not carry its share of the tax load.

S 64 Business should not worry about stable employment but should hire and fire as the need arises.

S 77 The demands made on a production manager by the problems of his particular function dictate that he will operate independently of other managers.

Of these nine statements on which a significant difference in response occurred, four can be easily rationalized. They are S 24, S 30, S 32, and S 44.

Statement S 24 makes reference to fewer problems with inventory when purchased parts are used. The experience of the game players with both purchased parts and raw materials inventory management can be asserted to account for the difference in response. The response of game players to statement S 30 also would indicate that they observed that both revenue and costs affect profits and hence a lower price and higher volume are not always profitable. The market price of shares in the complex game is a function of the firm's performance and is dramatically evident when performance is poor. Therefore, it is not surprising that the game participants should agree, in higher proportion, than non-participants. The awareness of game participants to competition is evident in the response to S 44.

The remaining statements S 20, S 25, S 51, S 64, and S 77 are difficult to rationalize. Since the "quality" of a product is a factor in the complex game it is likely that game participants would be more cognizant of its effect than non-participants. The particular response which they would yield is, however, not apparent. The fact that there is a significant difference on the response to S 25 must be a chance event since no unions exist in the game environment. Likewise, it is difficult to associate any aspect of the game with the response to statement S 51. The students participating in the game were faced with decisions on hiring, firing, and overtime as well as the problems of worker efficiency. Therefore, it is likely that their response to statement S 64 would differ from the response of non-participants. Again, it is not clear just what the response would be. Finally, it is indeed surprising that a significantly larger portion of game players feel that the production manager can operate independently of the other managers as witnessed by their response to statement S 77.

Table 1

Post Game Attitude Questionnaire

Statements for which the Responses were Significantly Different

		Fraction Agreeing	Fraction Uncertain	Fraction Disagreeing	N
S 20	Participants	.368	.026	.605	38
	Non-Participants	.064	.096	.838	31
	Difference	.303	-.070	-.233	
	t	2.970	-1.240	-2.120	
S 24	Participants	.078	.078	.842	38
	Non-Participants	.290	.096	.612	31
	Difference	-.211	-.017	.229	
	t	-2.300	-.260	2.150	
S 25	Participants	.342	.263	.394	38
	Non-Participants	.483	.064	.415	31
	Difference	-.141	.198	-.056	
	t	-1.190	2.160	-.470	
S 30	Participants	.684	.157	.157	38
	Non-Participants	.967	.000	.032	31
	Difference	-.283	.157	.125	
	t	-2.990	2.310	1.710	
S 32	Participants	.710	.026	.263	38
	Non-Participants	.419	.064	.516	31
	Difference	.291	-.038	-.252	
	t	2.430	-.770	-2.150	
S 44	Participants	.552	.078	.368	38
	Non-Participants	.354	.032	.612	31
	Difference	.197	.046	-.244	
	t	1.630	.820	-2.020	
S 51	Participants	.078	.078	.842	38
	Non-Participants	.000	.000	1.000	31
	Difference	.078	.078	-.157	
	t	1.590	1.590	-2.310	
S 64	Participants	.131	.000	.868	38
	Non-Participants	.000	.000	1.000	31
	Difference	.131	.000	-.131	
	t	2.090	0.000	-2.090	
S 77	Participants	.157	.026	.815	38
	Non-Participants	.000	.032	.967	31
	Difference	.157	-.005	-.151	
	t	2.310	-.140	-1.960	

C. The Fact and Concept Test

Although the attitude questionnaire yielded more significant differences in responses when the complex game was used with undergraduates, the fact and concept test yielded fewer. The following questions showed a significant difference in response:

Q 62 A buyer and seller have a conflict of interests and something in common at the same time.

Q 71 An increase in supply increases the price and decreases the quantity exchanged.

Q 90 Distributors or middlemen should be thought of as physical handlers rather than salesmen.

Q 98 Advertising is the most effective means of sales promotion.

From a close look at the game and the questions, it is impossible to attribute any effect to the game.

D. Conclusions

The experiment attempting to evaluate the effect of a complex management game with undergraduates was performed under far from ideal conditions. However, a number of explainable significant differences in response from the attitude questionnaire were found while no explainable differences were found on the fact and concept test.

Upon looking at the two experiments--undergraduates with the simple and complex games--the only apparent result is that the statements and questions on which significant differences were found differed, by and large, between the two experiments. Thus, no universal "business truth" or "attitude" provided by a game was measured. Since the business game is rather unstructured in nature, students apparently learn different things from different games. It is also likely that what a student learns is fragmentary and based on mere impressions rather than "hard" facts.

Table 2

Post Game Fact and Concept

Questions for which the Response was Significantly Different

		Fraction Answering True	N
Q 62	Participants	.868	38
	Non-Participants	1.000	31
	Difference	-.131	
	t	-2.090	
Q 71	Participants	.131	38
	Non-Participants	.000	31
	Difference	.131	
	t	2.090	
Q 90	Participants	.324	38
	Non-Participants	.580	31
	Difference	-.256	
	t	-2.120	
Q 98	Participants	.459	38
	Non-Participants	.709	31
	Difference	-.250	
	t	-2.070	

CHAPTER VI

AN EVALUATION OF A COMPLEX MANAGEMENT GAME IN A GRADUATE COURSE

by

H. E. Thompson and D. E. Schrieber

I. Introduction

In order to assess the effects of a complex management game in a graduate course two experiments were run. The first involved beginning graduate students and was performed during the spring semester of 1965. This run served as a pilot for the second experiment which was executed during the 1965-1966 academic year. These experiments were designed to test the following two hypotheses:

1. Students who participate in a management game acquire no better knowledge of facts or understanding of concepts than those who do not participate.

2. Students' attitudes toward management and business are not changed by management game play.

During the pilot run all 17 students in the class participated in game play. However, approximately one-half of the class played a simple management game for three weeks while the other one-half studied cases. Following these three-week sessions all students played a complex game for five weeks. During the five-week session a set of assignments was developed which integrated the game with the concepts of (a) planning, (b) organizing, (c) forecasting, (d) evaluating and controlling. The first three assignments were team efforts, while the last was completed by each individual.

The second experiment, conducted during the academic year 1965-1966, involved both participants and nonparticipants. The fall semester involved 33 students in a graduate management course as game participants. During the spring semester the 28 students in the same course served as a control group. The participating group (game players) was given two pre-game tests--attitude and fact and concept--and the same tests after completion of game play. The nonparticipating group was given the two tests at the start of the semester. These two tests were repeated after a period of time which was comparable to the entire play of the game.

In addition to the test instruments the participating group in the second experiment was given the same four assignments which were developed in the pilot study.

II. Test Results of the Second Experiment

Rather than attempt an evaluation of aggregate test acres an item analysis was first considered. Since the results in the case of both tests were meager, no aggregate analysis was performed.

Attitude questionnaire. In the attitude questionnaire the student must state whether he agrees, is uncertain, or disagrees with each of 77 statements in the questionnaire. He is allowed to express various strengths of agreement or disagreement.

In an analysis of post-game results four questions were found to have significant differences in the answers recorded by the participating and nonparticipating groups. There were:

S7. The government should regulate the price that business sets.

S13. In a multi-product firm, the wise manager chooses the products so the firm can compete at most or all of the various price levels in the market.

S66. Business can stay ahead of a recession by using contra-cyclical pricing.

S68. A company's cash flow position can be in its poorest condition when sales revenue is highest.

Although the number of significant differences is virtually the same as the number found in the case of a simple game in an undergraduate course, the specific statements are different.

Each one of the results found can be rationalized with respect to the game. As can be noted from Table I, the vast majority of students disagree with a statement that the government should regulate prices. This is clearly what would be expected from business school students. However, the fact that some percentage of participants appears to be uncertain could reflect their experience with the oligopolistic market of the business game.

The results reported on S13 possibly reflect the fact that participating students gained first-hand experience, via the game, with multi-product operations whereas those who did not participate had not thought about this question.

Statements S66-S68 also reflect the fact that the participants gained pseudo experience with certain problems which the non-participants had not encountered or had only treated theoretically.

Table I

Post Game Attitude Questionnaire

Statements for Which the Responses Were Significantly Different

		Fraction Agreeing	Fraction Uncertain	Fraction Disagreeing	Fraction No-Answer	N
S7.	Participant	.000	.147	.823	.029	33
	Nonparticipants	.035	.000	.964	.000	28
	Difference	- .035	.147	- .140		
	t	-1.11	2.11	-1.74		
S13.	Participants	.617	.088	.264	.029	33
	Nonparticipants	.357	.142	.500	.000	28
	Difference	.260	- .054	- .235		
	t	2.04	- .67	-1.90		
S66.	Participants	.411	.294	.264	.029	33
	Nonparticipants	.250	.142	.607	.000	28
	Difference	.161	.151	- .342		
	t	1.33	1.41	-2.71		
S68.	Participants	.058	.058	.852	.029	33
	Nonparticipants	.000	.000	1.000	.000	28
	Difference	.058	.058	- .147		
	t	1.30	1.30	-2.11		

By comparing the answers to individual questions from both the pre-game test and post-game test we find five significant changes for both participants and nonparticipants. Comparing this with the eleven significant changes for nonparticipants alone when a single game is used in an undergraduate course, we can conclude that the test measures very little attitude change and the game itself contributes little in the way of attitude change for graduate students.

Fact and Concept Test. Of the 113 questions on the fact and concept test only four show significant differences post game. In turn, one of these questions showed a significant difference on the pre-game test and therefore reflects a difference between groups rather than the effect of the game play.

The three questions which exhibited legitimate post-game differences were:

Q42. Cyclical movements in other countries can largely be ignored in terms of their effect on the U. S. economy.

Q61. Value is based on exchange.

Q86. Cross elasticity refers to the effect on A's demand of B's prices.

All three results are difficult to rationalize. Questions Q42 and Q61 are concerned with issues not involved in the game or the course in which the game was used while the result of question Q86 is not what would be expected.

From an analysis of pre-game and post-game responses six significant changes were found. When this is compared with the

Table II

Post Game Fact and Concept Test:

Questions for Which Responses Were Significantly Different

		Fraction Answering True	N
Q42.	Participants	.088	33
	Nonparticipants	.392	28
	Difference	- .304	
	t	-2.85	
Q61.	Participants	.941	33
	Nonparticipants	.750	28
	Difference	.191	
	t	2.12	
Q86.	Participants	.852	33
	Nonparticipants	1.000	28
	Difference	-1.47	
	t	-2.11	

18 changes found with the simple game experiment with undergraduates one must conclude that very little change was measured by the test. This result could be due to no changes actually taking place or to the fact that the test does not measure the changes. At any rate we must conclude that the business game showed no effect on graduate students according to the test.

In the next section we will discuss the results of student assignments as they bear upon both attitudes and facts and concepts as well as motivation.

III. Analysis of Student Assignments

A. Some Observations from the Pilot Run

In looking over the student assignments from the pilot run we are struck by the fact that very little in the way of specific facts about business operations is evidenced. However, the following comments indicate perhaps the most important specific fact which was learned or reinforced:

> I assumed that if a firm was making a profit then all was well, but we were doing just that and never had a decent cash position. The point being that the elements of finance take on a very different meaning than the usual textbook treatment.
>
> The most interesting concept I have learned in this game is that of the nature of working capital and cash flow. The concept of working capital is difficult to understand, but by checking these results I can see how funds shift in the course of business.
>
> . . . the value of the cash flow statement.

The divergence of profits and cash flows is apparently brought forth by the game.

The interpersonal aspects of management are most apparent when we look at student assignments from the pilot run. The pilot run class was made up of four teams with 3, 4, 4, and 6 members. As witnessed by their statements the firm with three members did not experience significant interpersonal problems. Their comments on organization related mainly to coordinating function.

> It is very apparent that if a firm is to succeed its management must work as a unit. There are no departments which can operate independently of the other departments and still have an efficient operation.
>
> One of the interesting aspects of playing this game was the experience of working on a committee, where members had equal authority in some matters and unequal authority in others . . . . It was sometimes necessary to take a vote on certain committee decisions but, for the most part, differences of opinion were worked out in an informal but very efficient manner.
>
> Perhaps had the team consisted of 7-10 members, more insight could have been gained in areas of delegation of authority and use of formal business organization.

From the limited experience with the other three teams the prediction expressed in the third quotation is evident. Students participating in four-man teams witnessed an increased involvement with interpersonal experience.

> The most important concept it reinforced was that of cooperation and coordination within an individual firm. Complete coordination is required between heads of the different departments, and this is only achieved through cooperation. It is one thing to read about this in a text, but something else to work with its actual necessity.

> . . . you have to remember that you are dealing with the human element. If you are positive that a business should take a certain course of action on a subject and three other people firmly hold to three different courses of action, you can not just follow your own whim, but rather the four of you must come to some kind of agreement without compromising the goals of the firm.
>
> This [proper organization structure] . . . is most apparent when there is a disagreement over a decision. We faced this situation over the question of the lost sales due to our inability to meet demand. And even with three out of our group of four desiring to increase production substantially we could not convince the one person to change his mind; and he did only after it was critically obvious that we were producing at too low a level.

With the six-man team the presence of interpersonal problems was paramount to the point of overshadowing all other problems. The serious nature of the dispute, involving two students of different cultural backgrounds,is apparent from the following comments:

> But [with] more than three persons you can't play this game because those who make decisions feel that they carry the burden of the game and [do] not want to understand that it is also other's right to make decisions. Those who wait to get the opportunity for making decisions feel frustrated.
>
> . . . if you insist on using those rating scales which are filled out by each individual about the others you can't prevent the teammates from leaving each other without greeting in the last class period.
>
> Having had not previous background or experience in business . . . , there were indeed many new things which I was introduced to in this complex management simulation game. I now know why managers get ulcers for one thing. Of course, I realize that this game is merely

simulating the real world and is therefore more rational. Maybe that was our problem; a rational game managed by irrational people.

Essentially the problem--revealed fully in the disastrous overtime and excess hiring decisions--was this: the President of a company (in this case, the Chairman of the Executive Committee) either gives way to his subordinates against his better judgment, in order to preserve amity, or he makes the decisions he feels to be right, and to hell with amity. All decisions made when the responsible subordinate disagrees with the chief executive must be one or the other or (just possibly) a combination of these. Of course, if the subordinate is consistently wrong, he will (in the real world) be fired. If a person who is given a job does not do it, he is fired (in the real world). But even in the real world there are exceptions.

One of the exceptions is relevant here. An American corporation, training foreign nationals, as a service to the government, cannot fire them, and if they prove incompetent, or if the language barrier is too great to be surmounted, the only thing to be done is to shunt them aside, and hope they will fail to notice the shunting--which is not exactly the predictable result. In a sense, owing chiefly to language difficulties perhaps, but with some plain ordinary failure to learn the rules of the Game, this was the situation here. A decision made in accordance with exhaustive research carried out by one of the production managers, though with a distinct belief that something was wrong, was nevertheless approved by me (which should never have been done) in the hope that I was wrong and that everything would come out smelling like a rose. It came out smelling like a skunk cabbage. And the last particular noxious whiff came when the same person seriously proposed making the same mistake again.

At this point--and I would count this, probably egotistically, as one of the correct management decisions--the committee structure essentially ceased to function, though the profit-centre organization was maintained, and all decisions were made arbitrarily by me, with the advice (and, except for the decision for Period Fourteen, the consent) of, two other members of the firm. But it must be acknowledged that the decision, so far as interpersonal relationships went, and international amity for that matter, was probably wrong. In the terms of the Game, measured by profit and inventory control and ratio of capital to labor, and consistency of production, the decision was right. But, considering the Game as a teaching device, though it was right for me, it was doubtless wrong for the person(s) shunted aside.

All the incorrect decisions except this particular hiring-firing-and-overtime fiasco could have been prevented, or at least their importance could have been minimized, by greater effort and greater attention devoted to the interrelation of labor costs, production rates, expected demand (more market research could have been used) and inventory control. I never did get the hang of overtime and decided to steer a course clear of that particular problem, after two misfortunes involving its unsuccessful use. But even I knew something was wrong in the hiring decision producing 1560 inefficient employees and astronomical indirect labor costs. Still, it seemed worthwhile to give the man rope. This was a mistake which could have been avoided with better character analysis, since the rope was only put to the purpose of lassoing and dragging in irrelevant facts, with labor costs broken down on a per-minute basis, and efficiency broken down altogether.

Altogether, I have probably spent too much time on this one decision but I can claim in extenuation--even if I have set down in malice--that this problem led to the chief management lesson of Game, or at least that I learned from the Game. That there was a subsidiary lesson, which may briefly be stated as "learn the rules before you begin to play," I am not denying. But, in the long-run, the lesson is that the business world pays off not on devotion to personal friendliness, consideration for others, desire to protect a man from his mistakes (all godlike qualities, it may be), but quite simply on devotion to Mammon. Sometimes, to be sure, there may be no divergence between the two. But given a choice, forced to a choice, one must choose Mammon. This much I learned by my experimentation. And I learned empirically the lesson about learning the rules and the ratios.

> I think there is one further comment called for. The Game, as a teaching device, is most valuable when there is full cooperation, and no language barrier, among all the members of the firm. Failing that, it is my guess (and on that guess I based my own strategy) that it is more valuable to the one person making the decisions than to the others, and more valuable to those among the others who acquiesce in the program than to those who do not.

B. Some Observations from the Second Experiment

The student responses to the question of what they had learned is a result of the second experiment yielded primarily generalizations along the lines of more acute awareness of the existence of certain problems, appreciation of problems of planning and integrating separate functions, and experience with interpersonal problems.

Contrasted with the results of the pilot run little mention of cash flow appears. However, since there is no study of production required for the MBA degree at the University of Wisconsin and since the Harvard Business School simulation has a substantial production element it is not surprising that a number of responses indicated an awareness of production problems:

> I was introduced to the problems faced by the production manager. This is one area that I would have admitted to a complete lack of appreciation before the game. The ideas of logs between ordering and receiving, receiving and starting production and from raw material to finished goods. I guess I was vaguely aware of, but I certainly did not realize the scheduling problems that they create.

> . . . before this, I knew little about the problems involved in production management. This game served to clarify some of the concepts.

> Became aware of the problems of production, and the inherent difficulties involved in personnel [decisions]. To produce a product efficiently demands many coordinated activities. In hiring and firing individuals the process involves more than just saying "you are hired" and "you are fired."

> I had not realized before how important these two factors [production and inventory control] are in a business. Through our mistakes in the game I think we can see that the job is not an easy one and takes skill to accomplish.

There were, however, references that indicated the awareness to other problems. Some are listed below:

> The value of leverage utilized in a reasonable manner was shown vividly by the operation of our firm.

> . . . perhaps of greatest significance was the idea introduced that most decisions made by the business enterprise are made without all the needed facts available. Decision making under uncertainty is the rule rather than the exception in the business enterprise.

Appreciation for the problems of planning and integrating business functions was the predominant perceived benefit of the game in the thoughts of the students. Some comments indicated its value as a practical application of concepts studied in courses.

> Undoubtedly the greatest value that the game has is that it integrates the various fields of business in a practical manner. This is probably the most practical experience that many of us have had.

> So many times a student will learn a particular concept or term and yet he really doesn't understand it until he sees how all the different variables and concepts enter the complex business environment.

> Previously I had learned each function separately in other courses. In this simulation I received experience in coordinating these functions in decision-making. I also felt that I was introduced to the concept of "strategy" in an ongoing concern and I also learned very quickly that we must plan ahead.

> The game also emphasizes the importance of planning in the business environment. Not only is it important to plan for your own strategy, but it is also important to plan and try to forecast your strategy within the context of your competition. The game player becomes aware of the need for planning for alternative courses of action when conditions force uncertainties upon him. He is constantly revising his strategy to obtain the optimum profit and operating efficiency.

As in the pilot run certain interpersonal problems arose from which the student obtained insight into that aspect of management.

> Throughout the game, I became aware of the psychology of management through a study in frustration. The personality struggle which took place within our firm pointed up many new aspects of management which I had previously not been aware existed. Although I personally had virtually no say in how our firm was run, I do believe and learned as much as the members who run our firm, both from the results of the decision and from this real opportunity to watch how decisions are made when conflict exists.

IV. Conclusions

There is some evidence that the instruments of measurement--the attitude questionnaire and the fact and concept test--showed greater changes from pre-test to post-test when used with undergraduates than with graduate students. This indicates a diminishing usefulness of the test for measuring the effects of the game on graduate students. This conjecture is supported by the fact that a number of graduate students expressed doubt that the tests could measure what they were intended to measure.

Although the tests showed no substantial effects of the game student responses to the question of what they had learned indicated that effects were present. The necessity for planning and integrating the various functions of a business was the predominant awareness which the participants expressed. This, of course, may be due to the fact that this is "what games are supposed to illustrate." However, another result offers positive evidence that there was an effect. An awareness of the problems of production management was evident. Since no course was required and since no student participating was a major in production it is clear that the awareness was a result of the game and not of course work.

The type of learning which prevails is apparently an awareness. Since students were guided only by the need to present reports on planning, organizing, forecasting, and controlling and were not guided in using specific procedures of analysis it is not surprising that this was the result. As noted by Dill and Dopelt[1] the game offers an important but low level of learning.

One can also conclude by considering the pilot run and the experiment that the type of learning that does result can be, to a great extent, controlled by the administration of the game. If the game is administered as has been the case with this experiment it is likely that the results will be the same. Every student will become aware of certain types of problems faced by business management. His trial and error procedures to the solution of these problems will not leave him with a great deal of insight on methods of solution. On the other hand close faculty supervision with the analysis of problems could result in a higher level of learning.

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[1] Dill and Dopelt, op. cit.

Even the specific problem areas which the student will encounter can be controlled to a certain extent by the administration of the game. As witnessed by the pilot study an increase in the size of the firm increased the experience of the participants with interpersonal problems. It also has the effect of reducing the awareness of problems of integration because of the specialization it requires. Interpersonal problems can reach such a magnitude that the student fails to gain full appreciation of the economic problems facing the firm. The reduction in size of team leads to a fuller appreciation of the economic problems but by and large a diminished awareness of interpersonal aspects of management.

In either case, large or small teams, without a massive effort on the part of faculty members only an awareness of problem develops rather than an analytical ability to handle them. To develop an awareness the complex management game appears to be an expensive device which is of questionable use. However, it may, with the proper combination of faculty effort, be the ideal way to develop analytical abilities.

CHAPTER VII

SOME BEHAVIORAL OBSERVATIONS ON THE ADMINISTRATION OF MANAGEMENT GAMES

by

L. J. Bossman, Jr.

> "Financial reports were shuffled, stared at, and read in silence. Phil, who had said little to this point, reached into his vest pocket and drew forth a small slide-rule. After a moment of silence, and a movement of his rule, Phil agreed that a balance sheet item had been correctly stated. Another moment of silence. . . the group's technician, but not its leader, had been found."

John, Carol, and Phil were members of a decision-making group which competed against other three-man groups in a classroom management game project. Each student group had been assigned the responsibility of management decision-making for a single-product, oligopolistic "firm," and this decision-making task extended over several consecutive quarters of the firm's business operations.

Selection of a management game for the classroom project was made in order to provide these student participants an opportunity for involvement in the total operational aspects of company decision-making, to benefit from a dynamic feedback system of decision results, to receive a training in long-run planning, and to gain insight into relationships among management functions.[1, 2, 3] As the slide-rule incident among Phil, John, and Carol might suggest, however, achievement of results such as these would appear to demand of each group member a learning experience highly dependent upon the conditions of the group environment in which the decision-making activity was conducted.

A major group condition proposed as conducive to effective group learning is that of the development of power dimensions within the group. These power dimensions--appropriately, dimensions of a group's power-structure--are assumed to be (a) the group's power dimension, (b) the leadership power dimension, and (c) the dyadic power dimension.

The group's power dimension refers to incluence which the group as a whole can bring to bear upon an individual group member. The dimension of group power is closely associated with the norms embraced by the group, and the exertion of group influence upon the individual

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[1] Greene, Jay R. "Business Gaming and Marketing Decisions," in Marketing Keys to Profits in the 1960's. ed. Wenzil K. Dolva. Chicago: American Marketing Association, 1960.

[2] Greenlaw, Paul S. "Marketing Simulations--Problems and Prospects," in Marketing: A Maturing Discipline, ed. L. Bill Marten Chicago: American Marketing Association, 1961.

[3] Lindsey, F. A. New Techniques for Management Decision Making. New York: McGraw-Hill Book Company, 1958.

member reflects the group's desire to achieve member compliance to those norms. Festinger has developed the latter concept in terms of the group's "force of public compliance" which may be directed at the individual member.[4] Contributions to the development of group norms, in turn, are traceable to every group member, at least to some extent. As Haythorn has described it, the performance of the group is affected by each person in the group, and to a certain extent, every person in the group is therefore a leader.[5]

The leadership dimension of power refers to influence which an individual member, in the role of leader, may exert upon the group. The individual who may emerge as group leader is that person who demonstrates his success in initiating and maintaining group structure for the group's operation toward and achievement of its purpose or goals.[6]

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[4] Festinger, Leon. "An Analysis of Compliant Behavior," in Group Relations at the Crossroads. ed. Muzafer Sherif. New York: Harper & Brothers, 1953.

[5] Haythorn, William. "The Influence of Individual Members on the Characteristics of Small Groups," in Small Groups Studies in Social Interaction. eds. A. Paul Hare, Edgar F. Borgatta, and Robert F. Bales. New York: Alfred A. Knopf, 1965.

[6] Stogdill, Ralph M. "Intragroup--Intergroup Theory and Research," in Intergroup Relations and Leadership. ed. Muzafer Sherif. New York: John Wiley & Sons, 1962.

The dyadic dimension, as Taylor has indicated, refers to the person-to-person relations among members of the group,[7] and the dyadic power dimension is considered here as person-to-person influence on relations among members of the group.

Closely related to the learning effect in a group decision-making situation are factors of member behavior which surround the workings of the power dimensions. Carter has described several behavioral factors which can be evaluated for persons who interact in a small-group situation, and two of these factors are of concern here; namely, an individual's group behavior which relates to his effort to achieve personal goals, and an individual's group behavior which relates to his contributions toward group goal achievement.[8]

It is the purpose of this paper to provide illustrations of several group decision-making situations drawn from summaries of selected observational studies of three-man groups which participated in a management game exercise. In these descriptions, attention is devoted to group member behavior related to achievement of personal goals and achievement of group goals, and an effort is made to ascertain the prominent power dimensions which may have developed within each group situation.

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[7] Taylor, F. Kraupl. "The Three-Dimensional Basis of Emotional Interaction in Small Groups." Human Relations, VII (November, 1954) 441-70.

[8] Carter, Launer F. "Recording and Evaluating the Performance of Individuals as Members of Small Groups," in Small Groups Studies in Social Interaction. eds. A. Paul Hare, Edgar F. Borgatta, and Robert F. Bales. New York: Alfred A. Knopf, 1965.

A Case of Well Defined Power Dimensions

Jim, Joyce, and Dan were members of a decision-making group in the management game class project. During the first group meeting, Jim emerged as leader of the group. His understanding of the technical terms and concepts contained in the firm's financial reports enabled him to instruct Joyce and Dan in the use and meaning of these concepts. Joyce was quick to comprehend Jim's explanations, but appeared concerned with the problem of what the group was to accomplish in matters of specific decisions. Joyce was eager to contribute comments and suggestions to the group, and naturally assumed the role of group secretary. Dan, during most of the first group meeting, attempted to become familiar with business terminology and American business customs. His foreign background initially created a barrier to member communication, but this barrier was overcome by the third group meeting. Thereafter, Dan gradually became more active in group discussions and in the contributions he made to decision-making.

To an outside observer or to any member of the group, Jim was readily evident as group leader. In private questioning, each member identified Jim as leader, and Jim also recognized himself in that role.

Despite this unanimous recognition, Jim attempted to maintain a democratic style of leadership. For example, great effort was made to please all members of the group with the final set of decisions derived in each meeting.

During the first few meetings, it appeared as if Jim had decided upon a certain strategy and plan for utilization of the firm's resources, attempting then, for the remainder of the group meeting, to convince Joyce and Dan of his decision proposal. However, as Joyce and Dan became more familiar with business terminology and the nature of decision-making, this situation became less evident. By the third session, Dan, especially, had become well acquainted with various aspects of decision requirements, and offered many suggestions concerning strategy formulations and their implementation.

Jim, as recognized leader, became the central "clearing house" for all communications among the group members. Questions and comments were directed to him and he, in turn, would ask another member for his or her opinion. Every suggestion and issue of strategy went through Jim, whether it required action by him or simply required clarification. This observation appears in agreement with Hopkin's proposal that the greater the centrality of a small-group member, the higher is his rank.[9]

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[9] Hopkins, Terrence. The Exercise of Influence in Small Groups. Totowa, New Jersey: The Bedminster Press, 1964.

A basic strategy of this group was to study, in the first several decision periods, the effects which decision-variable changes made upon the financial position of the firm, and this strategy was employed in an attempt to gain greater control over decision outcomes. In earlier meetings, the choice of decision-variables upon which to concentrate and the decision as to what changes should be made in their values provided the group with its most notable "bargaining" arena, and provided the leader with his greatest challenge in effective maintenance of group structure.

A second strategy developed by this group was to avoid having the firm's product price positioned at either extreme of the industry's price scale. To be the price leader of the industry meant that the firm might lose a share of the market, and to be the lowest in product price meant a likely reduction in profit earnings. Whenever the feedback from a previous decision period indicated that the firm was approaching either price extreme, the group attended to strategy adjustments for the price variable. These strategy adjustments required estimates of future industry price ranges, and the problem of estimation led to involved group discussion.

The issue of pricing arose in an earlier meeting, and the group's reaction to this issue exemplifies the working of its power dimensions. Jim proposed an increase in product price for the purpose of estimating the effect of price upon the firm's profit level and share-of-the-market. Joyce and Dan were very reluctant to accept this scheme, believing that the firm's high current market share should not be sacrificed for the sake of a price increase. For an entire meeting, the advantages and disadvantages were weighed for the proposed change, and finally, the members agreed upon a small five-cent increase. At the following meeting when it was learned that, despite a slight increase in the firm's earnings, the price rise had led to a decline in the firm's market share, Dan and Joyce were discouraged. But Jim quickly pointed out that the firm was still losing money. It was not before several periods had passed that Jim was able to convince the group that their losses would not change until the price was increased substantially. Agreement to raise the product price did not occur, however, until all other avenues of strategy were exploited.

The length of time required for Jim to convince the group of the required price increase was a reflection of his leadership quality. Although many other group ideas were originally his own, he sought always to obtain Joyce and Dan's full approval of these ideas even if it meant a substantial modification in his own planning; he avoided any tendency to autocratically impose his thinking upon the group.

This group subsequently led their firm through a continuously increasing profit trend, nearly doubling the firm's profit-earnings over eight business quarters.

In summary, one may note the existence of the three power dimensions in the decision-making acitivity of this group. The group's power dimension was evidenced in the formulation of guidelines for strategy development and decision-variable treatment. These guidelines tended to persist over time, and as in the case of the product pricing issue, the group constrained the leader in his preference for immediate change of these guidelines. The leadership dimension of power was, of course, most evident, first in the leader's position of centrality, and second, in his ability to eventually alter group guidelines over time. The dyadic power dimension was evidenced among members of the group not only in the fact that the members could contribute increasingly to group discussion as their personal understanding of the decision-making process was heightened, but also in the maintenance of group discussion in each meeting until a unanimous decision agreement was met among all members. Finally, one may note that the outstanding behavioral factor common to the members of this group centered upon contributions toward the attainment of group goals rather than toward achievement of personal goals.

A Case of "Shared" Leadership

In the first series of exchanges among the members of this group, a "sparring" effect was noted to occur. Each member appeared intent upon determining the ability of other members to overcome an obstacle of the unknown in a problem-solving situation. A general tenseness pervaded the group as members leafed through their financial reports and instruction pamphlets; each hesitated to offer an interpretation of the group's immediate task. Finally, John made an attempt to orient the group with the question, "Where do we begin?" After some discussion, it was mutually agreed that the task at hand was to develop approaches to reducing the firm's current state of net-loss.

Financial reports were shuffled, stared at, and read in silence until Carol attracted the group's attention by reviewing the financial terminology as described in the instructional pamphlet. Phil, who had said little to this point, reached into his vest pocket and drew forth a small slide-rule. John and Carol turned to Phil as if awaiting their first directive for the decision-making task. After a moment of silence and a "slip" of his rule, Phil agreed that a balance sheet item had been correctly stated. Another moment of silence. . . the group's technician, but not its leader, had been found.

Discussion began, once again, on various phases of the firm's production schedule, but confusion developed as to whether or not attention should first be devoted to the marketing and sales functions. With the realization that achievement of a better profit record was a primary group objective, suggestions were made among the members in an attempt to relate the effects of problem areas to the profit objective. Group interaction was soon directed at strategy formation.

Interaction in the first two sessions of group decision-making was positively oriented to task solution. Greater familiarity and a reduced tension were exhibited among the members after the second meeting. Group cohesiveness strengthened with each successive meeting while group interaction became more regular and predictable. The group assumed an attitude of professional compatibility.

The power of the group over its members became evident, as shared responsibility in decision-making evolved into a uniform pattern. In this pattern, the use of a uniform strategy and routine utilization of resource variables became standarized. Group cohesiveness continued to strengthen and the value attached to the group and group function became increasingly recognized by its members.

Members shared little or no hostility to the suggestions made by other members, but no individual of the group accepted the general leadership role. An attitude of shared responsitibility persisted throughout the group's decision-making sessions. The group's profitability record showed a major decline in the first periods, followed by a gradual, though consistent, increase in profit earnings over later business quarters.

In summary, member behavior in the group was strongly oriented toward achievement of group goals. This orientation was attributable to the prominent group power dimension which had rapidly developed. This power dimension was reflected in the group's consistent adherance to a single strategy. A leadership dimension of power had never developed among the group members, but, instead, a "shared responsibility" was assumed by the members, giving support to, and being supported by, the group power dimension. The dyadic dimension of power was evidenced to the extent that members facilitated a shared effort in the decision-making activity.

A Case of Attempted Leadership

In their group's first several decision-making sessions, Ken, Dave, and Ed allowed discussions to run in a free style form as they exchanged suggestions and comments. The group arrived at final decisions for the firm's quarterly operations as individual recommendations for each decision-variable were "balanced out" in a sequential manner; in the process, members appeared to support a give-and-take attitude in their exchange of opinions and ideas. This method of decision-making led to the formation of a very conservative strategy in which decision-variables were subjected to little, if any, change from one business period to the next, despite substantial money losses incurred by the firm in these periods. During decision-making sessions, no member attempted to assume a role of leadership, and no individual was recognized as a leader by other group members.

In later group decision meetings, Ken or Dave occasionally attempted to promote a different strategy or plan for the group decision. But, these suggestions were usually considered to be of insignificant consequence to the group. In one group meeting, however, Ken informed Ed and Dave that he had "heard" that product price increases employed by firms in another industry of the management game had resulted in an upswing in the firm's net-profits. Ken was convinced that increased product price was the key to successful results for his group's decisions as well, and urged Dave and Ed to adapt this plan. After some discussion, the group agreed to increase product price "by several dollars." When the group received the firm's financial reports in their following meeting, Dave and Ed discovered to their chagrin that the firm's net-profit level had, in fact, dropped markedly. Ken hastened to review the total financial report and discovered that an over-stocked inventory had also accumulated. Although he attempted to explain that the profit loss was actually the result of an over-stock in inventory as well as a poor advertising policy, Ed and Dave remained convinced that the trouble was caused by Ken's plan for price increase. From that point on, Ken was almost totally excluded from the group's decisions, as Dave and Ed reverted to the use of the original conservative strategy. The firm continued to operate at a loss throughout the remaining periods of its operation.

In summary, it would appear that member behavioral factors related to achievement of both group and personal goals were highly constrained by a notable element of conservatism in decision-making. This conservatism was a reflection of the group's power dimension which strongly bound the members to a single-track approach to their task. The leadership dimension of power was nonexistent; the dyadic power dimension among the group members was but moderate until the onset of negative dyadic relations between one member and each of the other two.

A Case of Radical Reaction

In their first decision meeting, Vern, Carl, and Bill were unsure of where to begin with their management assignment. Carl's attitude toward the decision-making task quickly developed into a negative one as, for the first time, he reviewed the financial report which indicated the firm's unstable state of operations. Carl's attitude was assumed by Bill and Vern after some interchange of comments. A low level of aspiration appeared among the members.

As the members examined the decision-variables which they were to control, more technical questions were directed to one another and more individual opinions were derived. Between questions and opinions, agreement was gradually reached regarding the treatment of each decision-variable, but frequent backtracking occurred as disagreements led to change or alteration of original opinions and decisions.

In the next two periods an atmosphere similar to that of the first period characterized the group. Results of previous decisions had showed little improvement in the operations of the firm. As the members sought new approaches to the treatment of decision variables, frequent disagreements continued to occur.

The group's first "success" occurred as a result of the third session's decisions. A substantial reduction had been achieved in the firm's operating losses. The same achievement was also accomplished in the following decision period. Improvement in group atmosphere was immediately apparent as disagreement among the members diminished. Affirmative and direct statements were delivered between members instead of the more usual exchange of questions and opinions. Group cohesiveness improved. Bill was responsive to this favorable group atmosphere and appeared to assume more of a leadership role. Decisions were made in an effort to preserve the general strategy which had recently proven successful.

In their sixth group meeting, Bill, Carl, and Vern were greatly discouraged to find a reversal of the previous trend in their firm's profitability. Market conditions had been unfavorable to the group's "success strategy," and the firm's financial condition was weakened greatly. The pattern of group interaction was also noticeably weakened as the group atmosphere appeared to revert to one of negativism. High rates of disagreement occurred, group cohesiveness diminished, and hostile attitudes developed between Vern and Carl. Indications of Bill's leadership were no longer in evidence. The former strategy employed by the group was abandoned and a "shot gun" scattering of approaches were bantered among the members as they sought simply to complete their decision-making task. The final outcome was a tremendous financial loss to the firm.

In summary, the limited development of power dimensions which occurred in the group was subject to conditions of group instability. Although dyadic relations among members appeared favorable to the group's decision-making activity in "prosperous" periods, dyadic relations were not constructive in periods of failure. The group's power dimension was notably erratic, and emergence of a leadership power dimension occurred in but a brief interim. Member behavior related to achievement of group goals was characterized by extreme attitudes of negativism and optimism. Member behavior related to the achievement of personal goals was somewhat evident in the high rate of diagreement noted to occur particularly in the group's non-prosperous periods.

It has been proposed that in decision-making groups participating in a management game, development of appropriate power dimensions within the group is necessary if effective learning is to occur among the group members. This proposal appears reasonable if the power dimensions are viewed in reference to the favorable effects which they can exert upon the group situation in which learning is to be derived. First, the group's power dimension is that dimension through which group solidarity may be promoted. Second, the group's power dimension may also serve to establish a high level of quality in the dyadic relations among group members; thus, member contribution toward achievement of group goals may be enhanced.

The leadership dimension of power is that dimension through which the leader may directly instruct his fellow group members in matters of decision-making. Through the leadership dimension, guidance and clarificatio of issues may be achieved, and attempts may be made to reduce member behavior devoted to personal goal-seeking. Because of the leader's position of centrality in the group, he may act so as to shape and influence the group's power dimension.

Through the dyadic power dimension, cooperative rather than competitive inter-member relations may be developed. More importantly, an appropriate dyadic power dimension provides channels through which individual members are free to offer contributions to strategy formulations and planning for utilization of resources.

But as has been illustrated in the group situations described above, it is possible that the leadership dimension of power may not reach a stable point in its development. It has also been illustrated that the group's power dimension may either falter under adverse conditions to which the group is exposed or confine the group's conceptualization of strategy formulation and decision-making to a narrow scope. Furthermore, the dyadic power dimension has been seen to be either advantageous or detrimental to individual attempts to participate in the group's decision-making procedure.

Effective use of the management game technique as an instructional medium is, therefore, in large part dependent upon the degree to which the development of appropriate power dimensions are facilitated within each decision-making group. Particularly important is the facilitation of the leadership dimension, for this power dimension is central to both the dyadic power dimension and the group's power dimension. The facilitation of power dimensions might be left to the "natural" involvement of interaction among student participants of each group, or it might be aided by the presence of an "instructional agent" who serves as a member of the group itself. In the former choice, development of appropriate power dimensions may well be left to chance, and the learning process among group members thereby hampered. For example, the likelihood that the leadership dimension of a group may fail to reach a stable state in its development is reflected in a finding of one study which indicated that in only nineteen of forty-seven cases could student members of three-man decision-making groups in a management game unanimously identify their group decision-leader.[10]

Use of an "instructional agent" within each decision-making group would appear to be a more feasible arrangement for the management game technique. Under this arrangement, an individual who is versed in a knowledge of the management game and who possesses an awareness of group interaction in decision-making, would act as a participating member of the group. He would contribute to the structuring of power dimensions within the group by:

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[10] Bossman, Larry J., Jr. Unpublished paper. University of Wisconsin, 1966.

1) providing a stable leadership dimension to the group in the event that a student member did not emerge as leader;

2) aid in developing "open channels" among members of the group so that favorable dyadic power relations may emerge among group members; and

3) provide guidance in developing the group's scope of thinking so as to engage a flexible, yet stable, group power dimension.

In reference to the provision of leadership, the instructional agent must be aware of allowing sufficient freedom for student members to assume the leader role, whereby the instructional agent would retrieve to an "advisory" position in the group. If this provision were not allowed for, a situation of conflict might easily arise between the instructional agent and ascending student leader, and the benefits of a guided group decision-making activity would then be forfeited.

In reference to his aiding in the development of "open channels" among group members, the instructional agent must be aware of status differences among student members which might impede member participation. As Torrance has indicated, suggestions offered by high status individuals in a group are most often selected by other members of the group who are close to him in prestige, while the suggestions of low status members tend to be by-passed.[11]

Provision of a "guided group decision-making" approach to management game participation has as its chief objective, then, the securement of internal group conditions attending the group's decision-making activity. This approach is recommended as a means of reducing the frequency of erratic group interaction, groping in strategy formulation, and ineffective learning consequences which may result among student participants who are left to prod their way through a complex problem-solving task.

Finally, it should be noted that employement of "instructional agents" in management game decision-making groups need not be appraised as too costly a use of personnel. An opportunity exists for the instructional agents themselves to focus attention upon inter-member group relationships, guiding and directing these relationships, while simultaneously observing the psychological, emotional, and social aspects of group decision-making. Thus, for the instructional agent--as well as for any observer of the group--the management game becomes an implement for observation of small-group processes.

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[11] Torrance, E. Paul. "Some Consequences of Power Differences on Decision Making In Permanent and Temporary Three-man Groups," in Small Groups Studies in Social Interaction. eds. A. Paul Hare, Edgar F. Borgatta, and Robert F. Bales. New York: Alfred A. Knopf, 1965.

Chapter VIII

SUMMARY AND CONCLUSION

The management game, after a decade, still remains something of an enigma. While surrounded by mystery, it has armies of defenders and detractors. Our attempts at resolving some of the mysteries and reducing the conflicts have not been entirely successful. Our conclusions, therefore, must remain largely conjectures based on some concrete experiences.

In order to assess the existing state of management gaming, a literature review and a survey were conducted. From these we found that little in the way of objective evidence on the effectiveness of games exists at this time. This state undoubtedly is changing. The early excitement over games has declined and the development of new games has slowed markedly. There appears to be an increased concern with the problems of administering games. Undoubtedly this change reflects a rethinking of the reasons for using games and a more profound attempt to integrate them effectively and efficiently into courses.

The experimental research which was conducted in this study was an attempt to ascertain what students learn from games. This question was considered under a number of circumstances: graduate and undergraduate courses; simple and complex games as adjuncts and as fully integrated parts of courses. In each case the following tentative hypotheses directed the research:

(i) Students who participate in a management game acquire no better knowledge of facts or understanding of concepts than those who do not participate.

(ii) Students' attitudes toward management and business are not changed by management game play.

(iii) Students who participate in a management game do not become more highly motivated in their study than those who do not participate.

The following conclusions result from the study:

1. Based on the test measurements we are forced to conclude that neither the simple game nor the complex game was effective when used as an adjunct to undergraduate courses. With respect to the fact and concept test and the attitude questionnaire, the questions and statements on which significant differences were found differed, by and large, between the two experiments. Thus, no universal "business truth" or "attitude" provided by a game was measured. Since the business game is rather unstructured in nature, students apparently learn different things from different games. It is also likely that what a student learns is fragmentary and based on mere impressions rather than "hard" facts.
2. There is some evidence that the instruments of measurement--the attitude questionnaire and the fact and concept test--showed greater changes from pre-test to post-test when used with undergraduates than with graduate students. This indicates a diminishing usefulness of the tests for measuring the effects of the game on graduate students.

3. Graduate student responses to the question of what they had learned from the game indicated some effects were present. The necessity for planning and integrating the various functions of a business was the predominant awareness which participants expressed. This, of course, may be due to the fact that this is "what games are supposed to illustrate." However, another result offers positive evidence that there is an effect. An awareness of the problems of production management was evident. Since no graduate student was required or in fact did take a course in production it is clear that the awareness was a result of the game and not of course work.
4. The type of learning resulting from the game is controlled, to a great extent, by the administration of the game. If the administration is "loose" it is likely that every student will become aware of certain types of problems faced by business management. His trial and error procedures to the solution of these problems will not leave him with a great deal of insight on methods of solution. On the other hand, close faculty supervision with the analysis of problems could change the pattern of learning.
5. The particular problem areas which the student will encounter can be controlled to a certain extent by the administration of the game. An increase in the size of the firm increases the experience of the participants with interpersonal problems. It also has the effect of reducing the awareness

of problems of integration because of the specialization it requires. Interpersonal problems can reach such a magnitude that the student fails to gain full appreciation of the economic problem facing the firm. The reduction in size of a team leads to a fuller appreciation of the economic problem but, by and large, a diminished awareness of interpersonal aspects of management.

6. Without a massive effort on the part of faculty members only an awareness of problems develops rather than an analytical ability to handle them. To develop only an awareness the complex management game appears to be an expensive device which is of questionable use. However, it may, with the proper combination of faculty effort, be the ideal way to develop analytical abilities.

CHAPTER IX

A SIMPLE MANAGEMENT GAME: STRUCTURAL EQUATIONS AND COMPUTING PROCEDURES

by

Howard E. Thompson and Leroy J. Krajewski

A. Introduction

The purpose of this report is to describe the structural equations and computing procedures of a simple management game. The reasons for the description are twofold. First, since the game has been used extensively in research activities at the School of Commerce of the University of Wisconsin it is important that the characteristics of the game be recorded. In the second place firms with sufficient computing capacity can incorporate the game into a training program without undue costs. Whereas the majority of games in existence at this date are rather complex requiring many manhours for each decision period, the game described below can be player with a single person operating each firm.

Although the game is specifically designed for play by a single person it is possible to include more than one person on a team. Three teams, or firms, make up each industry. Any number of industries can be included in a series of decision plays. The decision by the individual firms are made from information reported to them after each quarterly period in the form of accounting reports. These reports provide the only quantitative information which the participants receive. In spite of its simplicity of play, the game is realistic enough to demonstrate some of the essential considerations in marketing, production and financial management.

The general description of the game as it would be given to the participants makes up section II of this paper. Section III consists of a description of the structural equations of the model. The reports issued to the participants, the FORTRAN program, and operating instructions follow in the last section.

B. Game Description

The Industry

The industry under consideration supplies a consumption product for the durable goods industry (e.g., weldrods, abrasives). A very small number of participants (three) operate in the industry, and it is definitely oligopolistic in nature, with the decisions of each firm having a marked effect on the other firms. The industry is, in the long run, growing, but it is subject to the effect of the business cycle. Two indicators of the economy are available to the participants. They are the Gross National Product and the Durable Goods Production Index. At any time the general characteristics can be changed to bring in depressions or booms.

Manufacturing

Each firm operates a single factory possessing nine identical production lines. When the level of production is changed so that a line is taken away or added, a cost-of-production level change is incurred. This cost is due to hiring and laying off workers, and "bumping" caused by plant-wide seniority in the labor unions.

The cost situation in each factory can be controlled, to a certain extent, by the management. A heavy capital expenditures program will cause a decrease in variable costs by requiring less maintenance and by replacing labor with machinery; but, on the other hand, it will increase depreciation charges. Research into production improvements also serves to reduce production costs, but the reduction does not come as quickly as it might from capital improvements. The reduction in variable costs caused by capital expenditures and research effort is not proportional to expenditures, but follows the law of diminishing returns. The capacity of the plant is fixed and cannot be expanded in the game because of its short-run nature.

Distribution

Each firm owns a warehouse which is large enough to house any conceivable supply of inventory which the firm may generate. As in the case of the factory, there are certain fixed and variable costs associated with the warehouse. Retaining distributors tends to reduce the warehousing costs. Because of fluctuating industry sales, it is necessary for the firms to carry inventories for most efficient operation.

Payments for sales are not made immediately, but are made on account, with all accounts being paid within a certain fixed time. The distributor always receives a fixed discount and puts forth his own sales effort as a supplement to that of the particular firm.

Marketing

The fraction of the market gained by each participant depends upon his selling, advertising, and product research budgets, as well as the amount of business he sends to distributors and his selling price. In addition, a certain amount of good will can be built up by each firm. The good will is manifested in the tendency for customers to stay with the firm that gives them good service and a good product for their money. Running out of inventory is particularly damaging to the good will of a firm.

Decisions

The decisions are made by the participants with this general information in mind. The specific functions used in this model are not known to the participants. Their judgments as to the responses of certain aspects of their strategies must come directly from their experience and observations in the game.

There are nine specific decisions which must be made each period. They include the amount of money allocated to:

1. The selling budget
2. The advertising budget
3. The research and development budget
4. The capital expenditures budget
5. Investments, repayment of debt, or withdrawal from investments

In addition to these, four other decisions must be made. They are:

6. The price
7. The number of units to be produced
8. Fraction of sales to distributors
9. Fraction of research and development to production improvement

The decision for each period must be filled in on the decision form shown in Figure 1. These forms are then transferred to punched cards and processed by the FORTRAN program which follows.

The selling budget represents the number of salesmen in the field and the administrative cost of keeping them there. The selling budget, along with the distributor's selling effort, combine to effect the total selling effort of the firm. As might be expected, the law of diminishing returns is present in the relationship between selling effort and resulting share of the market. It is important for the participants to remember that a firm's market share depends not so much on the absolute size of its selling budget, but on its size in relation to what competitors are spending.

The advertising budget represents the amount spent on advertising during the period. This is the second factor in the determination of the share of the market. Again, it is the amount of advertising relative to competitors' advertising that counts, and the law of diminishing returns is also present.

The research budget is split into two parts by specifying the fraction that should be used on production improvement. The remaining portion goes to product improvement. Production research tends to reduce manufacturing costs; product research can improve product quality, which tends to increase market share. The research effort is one which takes time to bear fruit and, hence, not much effect can be felt in the period in which the expenditures take place. Gradually the effect of research wears off, so that a continuing research effort is desirable.

The price of a unit is the fourth and final factor in the determination of the share of the market. The price structure in the industry affects total demand. The cross-elasticity with respect to price is very volatile; that is, one firm's prices cannot be greatly different from its competitors' prices without its market share being severly affected.

The participant can choose what portion of his sales he wishes to sell through distributors. As was stated previously, the distributor puts forth selling effort for the firm in proportion to the amount of business he receives. The distributor's potential is a function of the share of the market the firm has. This reflects the fact that a more respected firm will find it easier to secure good distributors. The distributor receives a fixed discount and helps reduce inventory costs.

DECISION SHEET

PERIOD ______

FIRM	☐	1
SELLING BUDGET	☐☐☐☐☐☐	2
ADVERTISING BUDGET	☐☐☐☐☐☐	8
CAPITAL EXPENDITURES	☐☐☐☐☐☐	14
PRICE	b☐☐☐☐	20
UNITS OF PRODUCTION	☐☐☐☐☐☐	25
FRACTION OF SALES TO DISTRIBUTORS	☐☐☐	31
FRACTION R & D TO PRODUCTION	☐☐☐	34
R & D BUDGET	☐☐☐☐☐☐	37
DEBT REPAYMENT, INVESTMENT OR WITHDRAWALS	☐☐☐☐☐☐	43
GAME NUMBER	☐☐	45

FIGURE 1

The capital expenditures made are for cost reduction and normal replacement. Since the game considers only the short run, no expansion is possible. Capital expenditures serve to reduce the labor costs and, hence, variable costs. This cost-reducing effect lasts for a number of periods and then finally disappears.

Whenever the cash outlays for a period exceed the cash position, automatic borrowing takes place for the amount of the difference. Interest is charged on the debt until it is repaid. Investments and repayments of debt serve to repay any debt or invest excess cash. All investments and repayments are made at the beginning of the period. Any debt is assumed to be incurred at the end of the period. If a debt is incurred at the same time that plenty of cash is available in investments, the participant will be forced to pay one period interest before the debt can be repaid. Investments earn a fixed percentage, which is lower than the interest paid on borrowed funds.

C. Mathematical Structure

Definitions

In all cases the left subscript refers to the time period under consideration and the right subscript designates the firm.

The decision variables are:

${}_jX_i$ - the physical production for the period

${}_jCE_i$ - total dollars of capital expenditures in the period

${}_jRD_i$ - total dollars used for research and development in the period

${}_jSE_i$ - total dollars used for selling expense in the period

${}_jA_i$ - total dollars used for advertising in the period

${}_jP_i$ - price per physical unit in the period

${}_jP^d{}_i$ - fraction of sales to distributors in the period

${}_j{}^Cp_i$ - fraction of research and development devoted to production improvement

${}_j\Delta\Delta_i$ - total dollars invested (or payment on debt) during period

The ordinary variables are:

${}_jU_i$ - unit cost of production

${}_jV_i$ - unit variable cost of production

${}_jF_i$ - total fixed cost of production

${}_jD_i$ - the depreciation charges in the period

${}_jO_i$ - the fixed operating costs in the period

${}_jCs_i$ - the cost to start up or shut down one line

${}_jNL_i$ - the number of lines operating in the period

${}_j r_i$ - raw material cost per unit of production

${}_j \ell_i$ - remaining variable cost of production

${}_j VW_i$ - variable warehousing cost

${}_j I_i$ - value of the inventory at the end of the period

${}_j s_i$ - physical sales volume

${}_j S_i$ - dollar value of sales in the period

${}_j P_i$ - fraction of the market obtained

${}_j N$ - national sales in physical units

${}_j C_i$ - cost of goods sold in the period

${}_j Pr_i$ - profit in the period

${}_j T_i$ - income taxes paid in the period

${}_j E_i$ - total expenses in the period

${}_j B_i$ - total debt

${}_j BV_i$ - book value of the assets

${}_j \Delta_i$ - dollar value of investments

${}_j \Delta B_i$ - new debt in the period

${}_j IB_i$ - interest on debt

${}_jIA_i$ - income from investments

${}_jTA_i$ - total assets

${}_jCP_i$ - cash position

The parameters are:

$\bar{L}_i$ - average full capacity of one line per period

FW_i - fixed warehousing costs

f - distributor's discount

Z - capital expenditures weight function

g - research and development weight function

n_1 - length of advantage period for capital expenditures

n_2 - length of advantage period for research and development

λ_1 - cost to maintain one dollar in inventory in a distributor's warehouse for one period

λ_2 - cost to maintain one dollar of inventory in the firm's warehouse for one period

k_1 - return on investments

k_2 - interest rate on debt

d_1 - number of days within which all accounts are collected

d_2 - number of days per period

p_μ - fraction of accounts which are never collected

$\bar{d}_1$ - average day outstanding for accounts receivable

n - number of periods to write off a capital expenditure

ta_1 - income tax rate

LA_1 - lines available

Production

The unit cost of production for the i-th firm in the j-th month is given by

$$(1) \qquad {}_jU_i = {}_jV_i + {}_jF_i/{}_jX_i$$

where ${}_jV_i$ is the variable cost, ${}_jF_i$ is the fixed cost and ${}_jX_i$ is the production. The fixed cost can be broken down to the sum of operating expense, depreciation, and cost for changing the level of production.

This may be written as

$$(2) \qquad {}_jF_i = {}_jD_i + {}_jO_i + Cs_i \mid {}_jNL_i - {}_{j-1}NL_i \mid$$

where

$$(3) \quad {}_jNL_i = \begin{cases} [{}_jX_i \sqrt{L_i}\,] & \text{if } {}_jX_i \sqrt{L_i} \text{ is an integer, or} \\ [{}_jX_i \sqrt{L_i}\,] + 1 & \text{if it is not an integer.} \end{cases}$$

The brackets [ ] should be read as "the greatest integer in."

The unit variable cost of production is defined as a raw material cost, ${}_jr_i$, and a labor cost, ${}_j\ell_i$.

The labor cost will be adjusted by the amount put into capital expenditures and into research and development. In general we can say that

$$(4) \qquad {}_jV_i = {}_jr_i + {}_j\ell_i$$

and that

$$(5) \qquad {}_j\ell_i = {}_o\ell_i - \sum_{t=j-n_1}^{j} Z_t\,{}_tCE_i^* - \sum_{t=j-n_2}^{j} g_t\,{}_tRD_i^*.$$

The first term ${}_o\ell_i$ represents a fixed or base cost; the next two terms represent accumulated effects of capital expenditures and development work, respectively. The functions Z_t and g_t are chosen in such a way that ${}_j\ell_i$ can never be less than zero nor greater than ${}_o\ell_i$. As a practical matter, some ℓ_1 will be selected such that ${}_j\ell_i \geq \ell_1$.

The starred functions, ${}_tCE_i^*$ and ${}_tRD_i^*$, have the quality characteristics that they give full weight only to a certain critical capital expenditure, CE_i^o, and a certain critical research and development expenditure, RD_i^o. This does not mean that such a critical value actually exists and has been determined, but for purposes of the game it is so chosen. The starred functions have the following representation:

$$(6) \qquad {}_{t}CE_{i}^{*} = CE_{i}^{o}\,(1 + \tanh\,(a_{1}({}_{t}CE_{i} - CE_{i}^{o})))$$

where ${}_{t}CE_{i}$ is the actual capital expenditure in period t and CE_{i}^{o} is the critical value. Figure 2 shows the qualitative characteristics of ${}_{t}CE_{i}^{*}$.

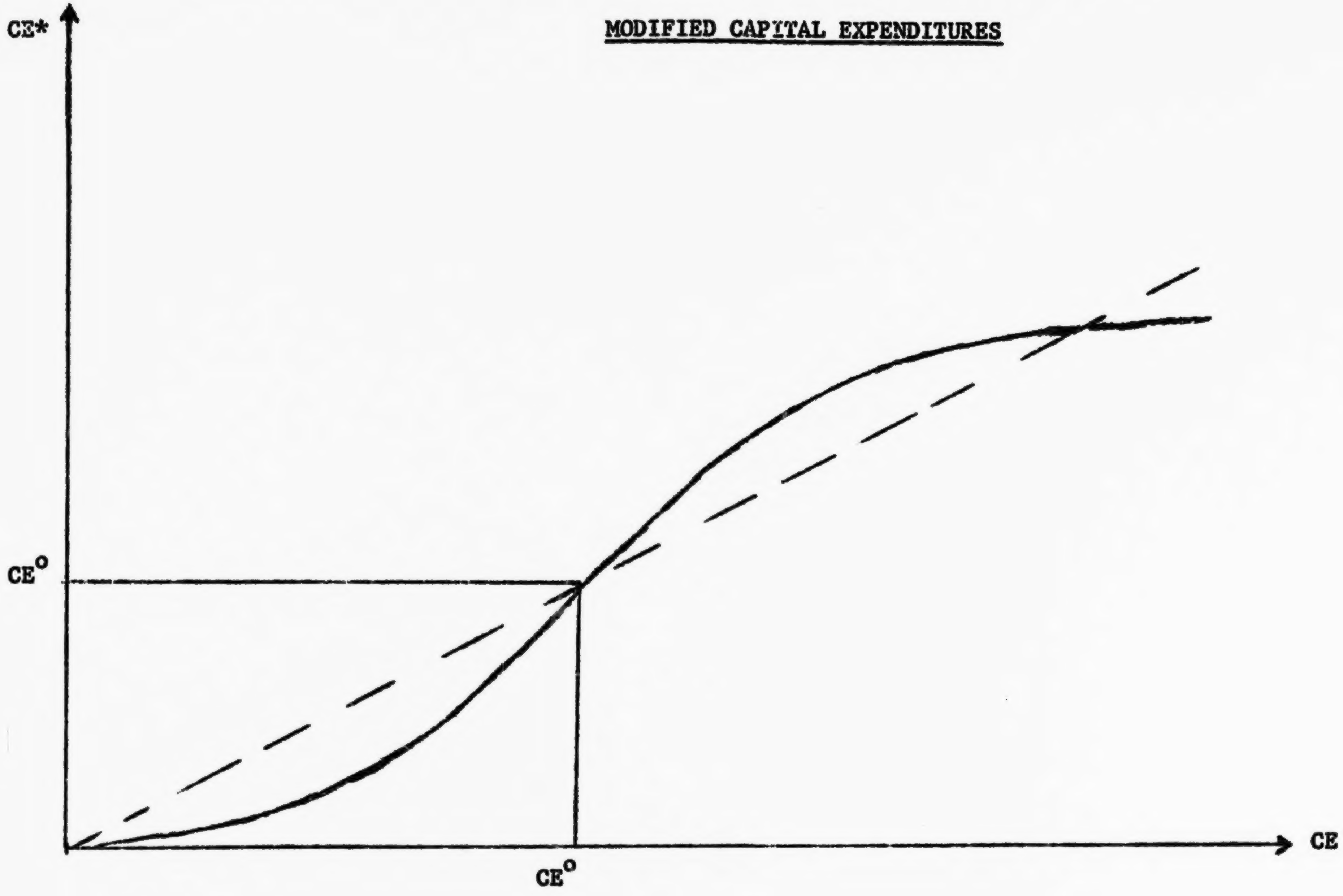
It should be noted that if firm i decides to spend a great amount on capital expenditures, they will receive benefits only to the extent of CE_{i}^{max}. The parameter a_1 tends to determine the distance between the high and the low points of the curve with respect to the abscissa. The same characteristics that are exhibited in the CE* function are also present in the other starred functions.

The function Z_t weights the value of capital expenditures over a specified period n_1, after which the advantage has worn off. This may mean that maintenance becomes high as the machine becomes older. Since new equipment does not always immediately contribute to more efficient production, the peak of efficiency is reached in some later period. The type of capital expenditures here are restricted to those that in some way facilitate production and do not expand the capacity of the plant.

The quality characteristics of Z_t can be seen in Figure 3. A function which exhibits the desired characteristics is

$$(7) \qquad Z_t = \begin{cases} G_z(1-\sin\,(-\Pi/2 - (t-j+1)/(n_1-1))) \text{ for } j-n_1 \leq t \leq j, \text{ or} \\ 0 \text{ for } t \leq j-n_1, \end{cases}$$

where G_z is a constant.



MODIFIED CAPITAL EXPENDITURES

FIGURE 2

CAPITAL EXPENDITURES WEIGHT FUNCTION

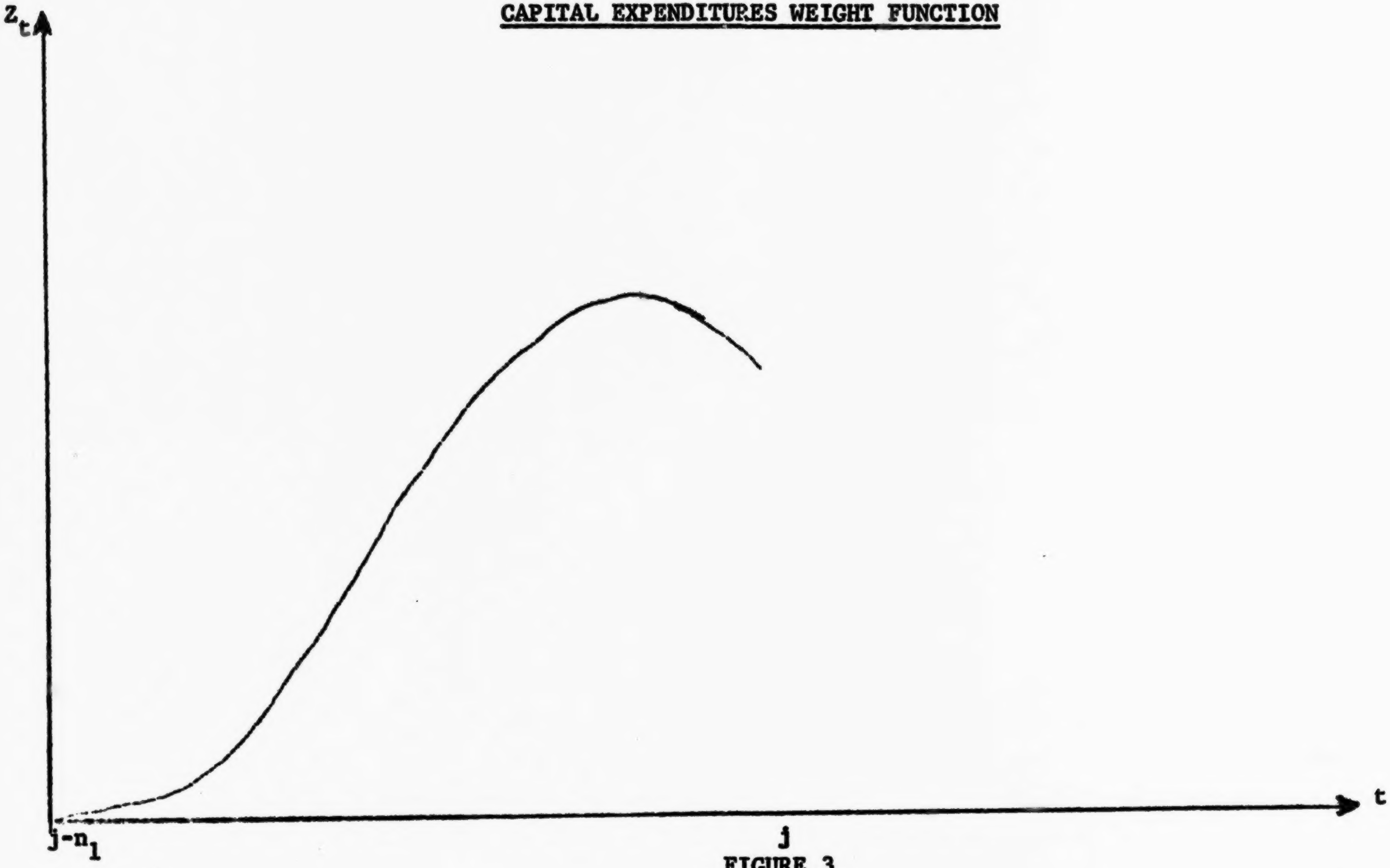


FIGURE 3

In a similar manner, the representation of RD* was chosen to be

$$(8) \qquad {}_tRD_i^* = RD_i^o\,(1 + \tanh\,(a_2({}_tRD_i - RD_i^o))).$$

The weighting function for research and development must reflect how much was spent on development of production methods and how much was spent on product improvement. The effects of recent research work, as well as long-past work, should only be reflected slightly, while the effects of work between the two extremes should have a higher weight. This weighing function, g_t, is characterized qualitatively by Figure 4.

A function which fits these characteristics is

$$(9) \qquad g_t = k\,C_{p_j}/(\exp(3 + 6(t-j)/n_2) + \exp\,(-3-6(t-j)/n_2))$$

provided g_t is truncated at j and $j-n_2$. The constant k serves to adjust research and development expenditures downward.

Warehousing Costs

Each firm is assumed to have a fixed warehousing cost, FW_i, per period. This represents their investment in warehousing facilities. The variable warehousing cost, ${}_jVW_i$, is a function of how much direct business is done and how much is done through distributors. The effects of sales regions and regional warehouses will not be considered. No attempt to include transportation to customers and between warehouses can be made. The warehousing cost can be expressed as

$$(10) \qquad {}_jWC_i = FW_i + {}_jVW_i\;{}_j\bar{I}_i$$

Here, ${}_j\bar{I}_i = ({}_{j-1}I_i + {}_jI_i)/2$ and ${}_jVW_i$ can be written as

$$(11) \qquad {}_jVW_i = (\lambda_1\,{}_jp_i^d + \lambda_2\,(1-{}_jp_i^d))$$

where ${}_jp_i^d$ is the fraction of sales to a distributor and λ_1, λ_2 are the costs to maintain a dollar of inventory in a distributor's and a firm's warehouse for one period. These costs λ_1, λ_2 are to be considered out-of-pocket costs and not opportunity costs, such as interest foregone.

Accounts Receivable

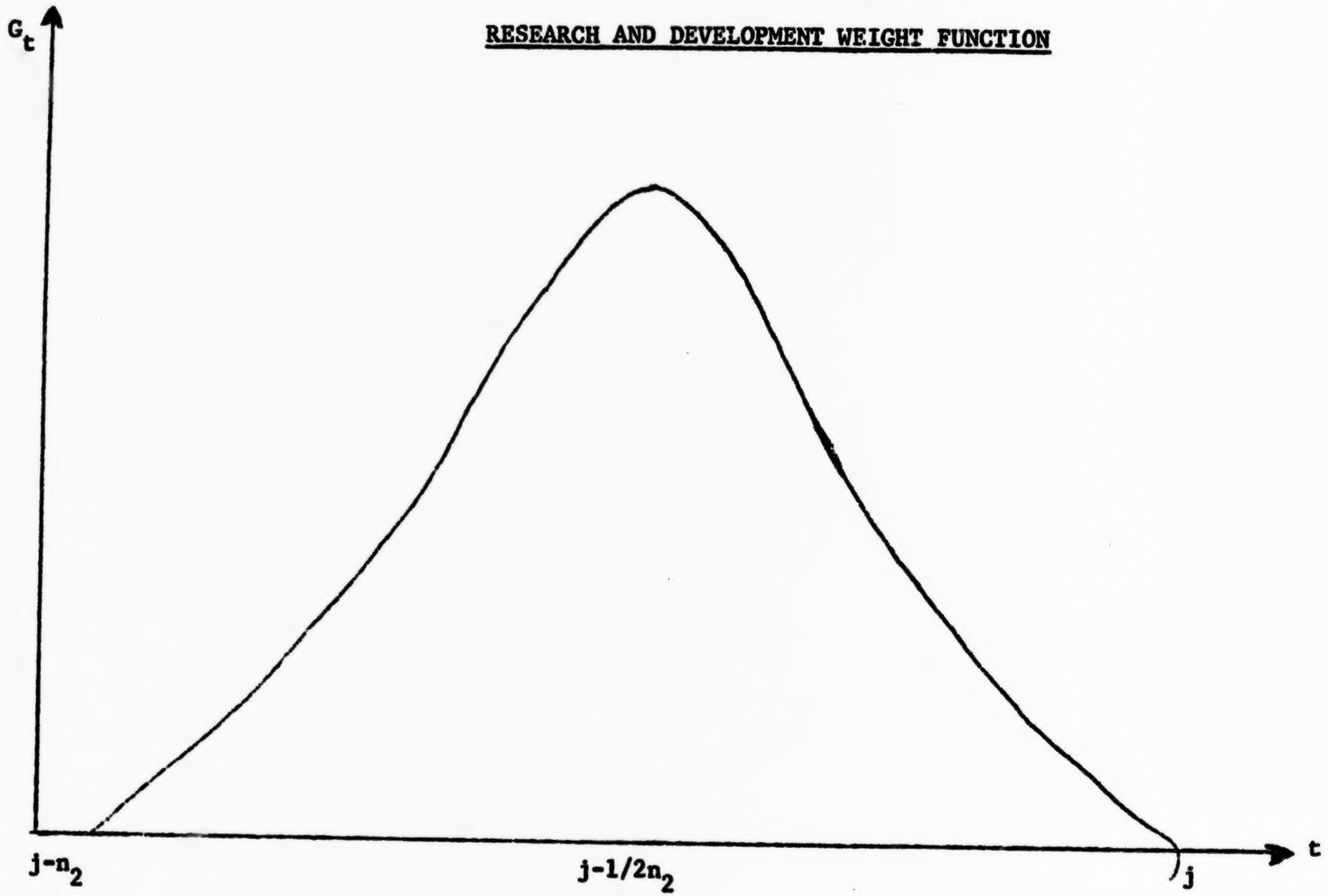
The accounts receivable (and the accounts collected) are important parts of the game, since they are factors in the cash flow of the firm. Let the dollar sales in period j be given by

$$(12) \qquad {}_jS_i = {}_jP_i\,(1-{}_jP_i^d)\,{}_js_i + (1-f)\,{}_jP_i\,{}_jP_i^d\,{}_js_i.$$

Since ${}_js_i$ is the physical sales volume, the first term represents the dollar value of sales made direct while the second term represents the dollar value of sales made through distributors. The factor f is the distributor's discount.

Suppose that the accounts are all collected within d_1 days and that there are d_2 days per period. Assume that d_1-d_2. If the sales for each period are evenly distributed over all d_2 days, then the average daily sales are ${}_{j-1}S_i/d_2$. Consider the following collection table:

R



RESEARCH AND DEVELOPMENT WEIGHT FUNCTION

FIGURE 4

COLLECTION TABLE OF ACCOUNTS RECEIVABLE

DAYS AFTER SALE	FRACTION COLLECTED
1	q_1
2	q_2
.	.
.	.
.	.
d_1	q_{d_1}

The accounts collected during period j would then be

$$(13)\qquad {}_{j}AC_{i} = (-q_1)\ {}_{j-1}S_i/d_2 + (1-q_2)\,{}_{j-1}S_i/d_2 + \dots$$

$$+ (1-q_{d_2})\ {}_{j-1}S_i/d_2 + (d_2-d_1)\ {}_{j}S_i/d_2 + q_{d_2}\ {}_{j}S_i/d_2 + \dots$$

$$+ q_{1_j}\ S_i/d_2$$

or

$$(14)\qquad {}_{j}AC_{i} = {}_{j-1}S_i\ (d_1 - \sum_{t=1}^{d_1} q_t)/d_2 + {}_{j}S_i(d_2-d_1 + \sum_{t=1}^{d_1} q_t)/d_2.$$

If we assume that a certain fraction, p_μ, of the accounts are never collected, then

$${}_{j}AC_{i} = {}_{j-1}S_i\ (d_1-(1-p_\mu))/d_2 + {}_{j}S_i\ (d_2-d_1 + (1-p_\mu))/d_2$$

Unfortunately, such records are seldom kept. However, the average day outstanding is usually known. Letting the average day outstanding be $\bar{d}_1$, the formula for accounts collected becomes

$$(15)\qquad {}_{j}AC_{i} = (\bar{d}_{1_{j-1}}\ S_i + (d_2-\bar{d}_1)\ {}_{j}S_i)\ (1-p_\mu)/d_2.$$

The accounts receivable for the j-th period are given by

$$(16) \quad {}_{j}AR_{i} = {}_{j-1}AR_{i} + {}_{j}S_{i} - {}_{j}AC_{i}.$$

Fraction of the Market

The demand for the product under consideration is affected by industry price structure. It also has some cross-elasticity. The relationships to these cross-elasticities are not known and would be virtually impossible to determine. For this reason, an arbitrary demand function for each firm must be chosen. Since quality of product is important, there is a tendency for a customer to stay with a manufacturer who has provided good service in the past. In other words, a certain amount of good will can be built up.

Following the Bellman game,[1] these relationships are defined in terms of relative attractiveness. The relative advertising position of the i-th firm can be given by

$$(17) \quad {}_{j}a_{i} = {}_{j}A^{*}_{i} / \sum_{i} {}_{j}A^{*}_{i}, \text{ where}$$

$$(18) \quad {}_{j}A^{*}_{i} = A^{o}_{i} \left(1 + \tanh \left(a_{3} \left({}_{j}A_{i} - A^{o}_{i}\right)\right)\right).$$

---

[1] Bellman, Richard, "On the Construction of a Multi-State, Multi-Person Business Game," Operations Research, Vol. 5, No. 4, August, 1957.

Similarly, for selling expense

(19) $\quad {}_{j}se_{u} = {}_{j}S^{1}_{i} / \sum_{j} {}_{j}S^{1}_{i}$, where

(20) $\quad {}_{j}S^{1}_{i} = {}_{j}SE^{*}_{i} + {}_{j}P^{d}_{i}\,{}_{j-1}p_{i}\ SD.$

The term SD represents the total industry distributor potential. As in the case of the other starred functions

$$ {}_{j}SE^{*}_{i} = SE^{o}_{i}\,(1 + \tanh\,(a_{4}\,({}_{j}SE_{i} - SE^{o}_{i}))). $$

The relative research and development position is based on a weighted accumulation of expenditures. This weighted accumulation will be given by

(21) $$ {}_{j}\overline{RDA}_{i} = \sum_{t=j-n_{3}}^{j} \gamma_{t}\,{}_{t}RD^{*}_{i}. $$

The function γ_{t} differs from g_{t} only by the multiplier $1-Cp_{t}$. Thus

(22) $\quad \gamma_{t} = (1 - Cp_{t})g_{t}.$

The relative position with respect to research and development can be given by

(23) $\quad {}_{j}rd_{i} = {}_{j}\overline{RDA}^{*} / \sum_{j} {}_{j}\overline{RDA}^{*}_{i}$

Given these factors and the price the fraction of the market obtained by firm is given by

(24) $\quad {_jP_i} = {_jf_i}/\sum_j {_jf_i}$, where

(25) $\quad {_jf_i} = {_{j-1}P_i} + \beta_i \exp\,(c_{1_j}\; a_i + c_{2_j}\; se_i + c_{3_j}\; rd_i - c_{4_j}\; \xi_i)$,

where ${_j\xi_i} = {_jP_i}/\,\overline{P}_i$.

The constant c_4 determines the ultimate weight of price in the calculation. The constants β_i determine how quickly the market reacts to the action in period j.

As $\beta_i \rightarrow \infty$.

The action in period j becomes more and more the dominant factor in the allocation of the market. In other words, the past has less weight as β_i gets large.

The term ${_{j-1}P_i}$ automatically injects a degree of stability into the simulation. It makes it difficult for market leadership to be wrested away from the large manufacturer in a few periods. Now, if ${_jN}$ represents the national sales for period j, then

(26) $\quad {_jS_i} = {_jp_i}(1-{_jP_i^d})\;{_js_i} + {_jp_i}\;(1-f)\;{_jP_i^d}\;{_js_i}$

$$= ((1-\,{_jp_i^d}) + (1-f)\;{_jp_i^d})\;{_jp_i}\;{_jP_i}\;{_jN}$$

as long as

(27) $\quad {_jP_i}\;{_jN} \leq {_{j-1}i_i} + {_jX_i}$.

In (27) ${}_{j-1}i_i$ stands for physical inventory at the beginning of the period. If (27) does not hold, then ${}_js_i = {}_{j-1}i_i + {}_jX_i$ and the rest of the market must be divided between the remaining firms. This restriction automatically penalizes the firm which runs out of stock by decreasing their good will, which is reflected in ${}_{j-1}P_i$ in the next period.

National Sales

The national sales follow a long-term trend with a short-term cyclical movement. The true natures of both are disguised within the random fluctuations which occur each period.

The sales can be expressed as

$$(28) \qquad {}_jN = h(\eta) + \sum_{k=1}^{j} b_k + m_1 \sin (m_2 j\Pi) + m_3 + m_7 ({}_j\bar{P}_i - m_8)$$

where h is the random element, Σb_k is the trend element and $m_1 \sin (m_2 j\Pi)$ is the short-term cyclical movement. The function h is given by

$$h(\eta) = \sigma(\eta - .5)$$

where $0 \leq \eta \leq 1$ and possesses rectangular distribution.

Two indicators of the economy are provided. They are the gross national product and the durable goods production index. In the game, these represent the trend of the economy and its business cycle, respectively.

The GNP if given by

$$GNP = m_4[m_3 + h(\eta) + \sum_{k=1}^{j} b_k]$$

and the durable goods index by

$$DGI = m_5 + m_6 m_1 \sin (m_2 j\Pi).$$

Depreciation

Each firm uses the constant percentage method of depreciation. All purchases of capital equipment are assumed to be distributed throughout the period, for purposes of depreciation calculation. Thus, if ψ is the depreciation percentage, the depreciation charges in the year are

(29) $\quad {}_jD_i = ({}_{j-1}BV_i + .5\,{}_jCE_i)\psi$, and the book value of the assets is then

$${}_jBV_i = ({}_{j-1}BV_i + {}_jCE_i)\ (1-\psi) - .5\,{}_jCE_i\psi.$$

Investments, Debt and Miscellaneous Formulae

Any specified repayment of debt, investment, or withdrawals from investments is to be made at the beginning of the period. Any specified investment must first be used to pay an existing debt, if one exists. If there is any excess after the debt has been paid, it will be invested. Let ${}_j\Delta\Lambda_i$ stand for a repayment, investment, or withdrawal. When ${}_{j}\Delta\Lambda_{i} < 0$, a withdrawal is understood. Two situations exist; they are (1) ${}_{j}\Delta\Lambda_{i} > 0$, and (2) ${}_{j}\Delta\Lambda_{i} \leq 0$.

In situation (1), the debt position at the instant after the transaction of ${}_{j}\Delta\Lambda_{i}$ is

$$(30) \qquad {}_{j}\hat{B}_{i} = \Theta\ ({}_{j-1}B_{i},\ {}_{j}\Delta\Lambda_{i})$$

and the investment is

$$(31) \qquad {}_{j}\hat{\Lambda}_{i} = {}_{j-1}\Lambda_{i} + \Theta\ ({}_{j}\Delta\Lambda_{i},\ {}_{j-1}B_{i})$$

where ${}_{j}\Lambda_{i}$ signifies the investment position and ${}_{j}B_{i}$ signifies the debt position. The function Θ is defined as follows

$$(32) \qquad \Theta\ (x,y) = \begin{cases} x-y \text{ if } x > y \\ 0 \quad \text{if} \leq y \end{cases}$$

The equations for case (2) can be written as

$$(33) \qquad {}_{j}\hat{B}_{i} = {}_{j-1}B_{i} + \Theta\ (\ |{}_{j}\Delta\Lambda_{i}|, {}_{j-1}\Lambda_{i})$$

and

$$(34) \qquad {}_{j}\hat{\Lambda}_{i} = \Theta\ ({}_{j-1}\Lambda_{i},\ |{}_{j}\Delta\Lambda_{i}|).$$

The income from investments and the interest expense will be

$${}_{j}I\Lambda_{i} = k_{1}\ {}_{j}\hat{\Lambda}_{i}$$

and

$${}_{j}IB_{i} = k_{2_{j}}\ \hat{B}_{i}$$

respectively, where k_1 and k_2 are the rates of return and interest. Letting ${}_{j}C_{i}$ be the cost of goods sold, the expenses in the period can be written as

$$(35) \qquad {}_{j}E_{i} = {}_{j}C_{i} + {}_{j}RD_{i} + {}_{j}SE_{i} + {}_{j}A_{i} + {}_{j}WC_{i} + {}_{j}IB_{i}$$

The profit can be expressed as

$$(36) \qquad {}_{j}Pr_{i} = {}_{j}S_{i} + {}_{j}I\Lambda_{i} - {}_{j}E_{i}$$

and the taxes are

$$(37) \qquad {}_{j}T_{i} = ta_{i}\ {}_{j}Pr_{i}$$

where ta_i is the rate for Firm i.

The cash position of the firm at the end of the period can be developed in the following way. Let

$$(38) \qquad {}_{j}\widehat{CP}_{i} = {}_{j-1}CP_{i} - {}_{j}\Delta\Lambda_{i} + {}_{j}AC_{i} - {}_{j}U_{i}\,{}_{j}X_{i} - {}_{j}RD_{i}$$
$$- {}_{j}SE_{i} - {}_{j}A_{i} - {}_{j}CE_{i} + {}_{j}D_{i}.$$

Then the increase in borrowings becomes

$$(39) \qquad \Delta\,{}_{j}B_{i} = \begin{cases} -\,{}_{j}\widehat{CP}_{i} & \text{if } {}_{j}\widehat{CP}_{i} < 0 \\ 0 & \text{if } {}_{j}\widehat{CP}_{i} \geq 0. \end{cases}$$

Because of automatic borrowing, the cash position always remains positive or zero. It is expressed as

(40) $${}_jCP_i = {}_jCP_i + {}_j\Delta B_i.$$

The value of company investments becomes

(41) $${}_j\Lambda_i = (1 + k_1)\ {}_j\hat{\Lambda}_i$$

and the indebtedness is

(42) $${}_jB_i = (1 + k_2)\ {}_j\hat{B}_i + \Delta_j B_i.$$

The cost of goods sold is calculated on an average cost basis. The basic formula is

(43) $${}_jC_i = {}_js_i\ ({}_{j-1}I_i + {}_jX_{ij}U_i)/({}_{j-1}i_i + {}_jX_i).$$

The valuation of the remaining inventory is

(44) $${}_jI_i = ({}_{j-1}I_i + {}_jX_{ij}U_i)\ ({}_{j-1}i_i + {}_jX_i - {}_js_i)/({}_{j-1}i_i + {}_jX_i).$$

D. Sample Reports, FORTRAN Programs, and Operating Procedures

Sample Reports

The results of the participants decisions, calculated from the structural equations presented in section III, are made available in the form of operating, profit-loss, cash flow, balance sheet, and market research statements. Each firm receives only its own set of statements after the conclusion of each simulated period.

The administrator of the game is provided with a game summary for each period. This provides him with a capsul view of the industry. On this sheet next to the selling, advertising, and research expenses are listed the relative factors calculated by equations (20), (17), and (21). With this summary the administrator can explain most of the situations which arise in game play.

The reports for each firm and the administrator for one industry and one period in Figures 5-11.

Figures 5-11

Operating Statement Firm 1 Period 1. Game 5.

Sales	147333.	Production	150000.
Price	16.00	Physical Inventory	51667.
Share of Market	.33	Fraction to Distributors	.20
Unit Mfg. Cost	15.42		

Profit-Loss

Sales Revenue		2310180.00
Less Cost of Goods Sold		2292740.00
Gross Margin		17440.00
Less Operating Expenses		
Selling Expense	120000.00	
Advertising Expense	40000.00	
Warehousing Costs	49674.80	
Research Expense to Prod.	18750.00	
To Product	18750.00	
Total Operating Expenses		247170.00
Operating Profit		-229730.00
Plus Nonoperating Income		
Other Income	.00	
Interest Expense	.00	
Net Nonoperating Income		.00
Net Profit Before Taxes		-229730.00
Less Taxes		-119459.00
Net Profit		-110271.00

```
                          Cash Position


Previous Cash Position                                    900000.00
Accounts Collected                                       1873440.00
Depreciation                                               75625.00
Withdrawals From Investments                                    .00
New Loans
   Total Costs                      2560440.00
   Taxes                            -119459.00
   Capital Expenditures               50000.00
   New Investments or Repayments           .00
Net Cash Position                                         358080.00


                        Balance Sheet Items


Cash                                                      358080.00
Investments                                                     .00
Accounts Receivable                                       770070.00
Inventory Value                                           845522.00
Net Fixed Assets                                         2974370.00
   Debt                                    .00
Net Assets                                               4948040.00


                        Market Research

                     Firm 1     Firm 2      Firm 3

Price                 16.00      16.00       16.00
Selling Expense      120.00     120.00      120.00
Advertising Exp.      40.00      40.00       40.00
Fraction to Dist.       .20        .20         .20

GNP 368.00     Durable Goods Index 1.70
```

Operating Statement Firm 2 Period 1. Game 5.

Sales	147333.	Production	150000.
Price	16.00	Physical Inventory	51667.
Share of Market	.33	Fraction to Distributors	.20
Unit Mfg. Cost	15.42		

Profit-Loss

Sales Revenue		2310180.00
Less Cost of Goods Sold		2292740.00
Gross Margin		17440.00
Less Operating Expenses		
Selling Expense	120000.00	
Advertising Expense	40000.00	
Warehousing Costs	49674.80	
Research Expense to Prod.	18750.00	
To Product	18750.00	
Total Operating Expenses		247170.00
Operating Profit		-229730.00
Plus Nonoperating Income		
Other Income	.00	
Interest Expense	.00	
Net Nonoperating Income		.00
Net Profit Before Taxes		-229730.00
Less Taxes		-119459.00
Net Profit		-110271.00

Cash Position

Previous Cash Position		900000.00
Accounts Collected		1873440.00
Depreciation		75625.00
Withdrawals From Investments		.00
New Loans		
Total Costs	2560440.00	
Taxes	-119459.00	
Capital Expenditures	50000.00	
New Investments or Repayments	.00	358080.00

Balance Sheet Items

Cash		358080.00
Investments		.00
Accounts Receivable		770070.00
Inventory Value		845522.00
Net Fixed Assets		2974370.00
Debt	.00	
Net Assets		4948040.00

Market Research

	Firm 1	Firm 2	Firm 3
Price	16.00	16.00	16.00
Selling Expense	120.00	120.00	120.00
Advertising Expense	40.00	40.00	40.00
Fraction to Dist.	.20	.20	.20

GNP 368.00 Durable Goods Index 1.70

Operating Statement Firm 3 Period 1. Game 5.

Sales	147333.	Production	150000.
Price	16.00	Physical Inventory	51667.
Share of Market	.33	Fraction to Distributors	.20
Unit Mfg. Cost	15.42		

Profit-Loss

Sales Revenue		2310180.00
Less Cost of Goods Sold		2292740.00
Gross Margin		17440.00
Less Operating Expenses		
Selling Expense	120000.00	
Advertising Expense	40000.00	
Warehousing Costs	49674.80	
Research Expense to Prod.	18750.00	
To Product	18750.00	
Total Operating Expenses		247170.00
Operating Profit		-229730.00
Plus Nonoperating Income		
Other Income	.00	
Interest Expense	.00	
Net Nonoperating Income		.00
Net Profit Before Taxes		-229730.00
Less Taxes		-119459.00
Net Profit		-110271.00

Cash Position

Previous Cash Position		900000.00
Accounts Collected		1873440.00
Depreciation		75625.00
Withdrawals From Investments		.00
New Loans		
Total Costs	2560440.00	
Taxes	-119459.00	
Capital Expenditures	50000.00	
New Investments or Repayments	.00	
Net Cash Position		358080.00

Balance Sheet Items

Cash		358080.00
Investments		.00
Accounts Receivable		770070.00
Inventory Value		845522.00
Net Fixed Assets		2974370.00
Debt	.00	
Net Assets		4948040.00

Market Research

	Firm 1	Firm 2	Firm 3
Price	16.00	16.00	16.00
Selling Expense	120.00	120.00	120.00
Advertising Expense	40.00	40.00	40.00
Fraction to Dist.	.20	.20	.20

GNP 368.00 Durable Goods Index 1.70

Game Summary Period 1. Game 5.

	PRICE	SELLING EXPENSE		ADVERTISING EXPENSE		RESEARCH EXPENSE TO PRODUCT		SHARE OF MARKET
1	16.00	120000.00	.3333	40000.00	.3333	1875.00	.3333	.33
2	16.00	120000.00	.3333	40000.00	.3333	1875.00	.3333	.33
3	16.00	120000.00	.3333	40000.00	.3333	1875.00	.3333	.33

	CAPITAL EXPENDITURES	RESEARCH EXPENSE TO PROD.	PRODUCTION	UNIT MFG COST	NET PROFIT
1	50000.00	18750.00	150000.00	15.42	-110271.00
2	50000.00	18750.00	150000.00	15.42	-110271.00
3	50000.00	18750.00	150000.00	15.42	-110271.00

B. FORTRAN Program

In order to make this report self-contained a complete copy of the IBM 1410 FORTRAN program follows. There are two parts to the program. The first, called the INITIALIZER program is used to create an initial history tape for the start of the game session. The second, called the GAME program is used in the actual running of simulated decisions.

INITIALIZER: Operating Instructions and Program Listing

This program creates an initial history tape on tape unit 1. A certain degree of flexibility has been introduced allowing each industry to have a different initial history. Beginning data must be entered for each industry on sixteen history input cards, in the following format:

FOR FIRM 1

CARD 1

COLS	FORMAT	SUGGESTED VALUE P	DESCRIPTION
1-10	xxxxxxx.xx	6.00	Number of lines available
11-20	xxxxxxx.xx	3000000.00	Book value
21-30	xxxxxxx.xx	.33	Fraction of the market
31-40	xxxxxxx.xx	1000000.00	Sales
41-50	xxxxxxx.xx	49000.00	Physical inventory
51-60	xxxxxxx.xx	825000.00	Dollar value of inventory
61-70	xxxxxxx.xx	333333.00	Accounts receivable
71-80	xxxxxxx.xx	0.00	Debt

CARD 2

COLS	FORMAT	SUGGESTED VALUE	DESCRIPTION
1-10	xxxxxxx.xx	0.00	Investments
11-20	xxxxxxx.xx	900000.00	Cash Balance

CARD 3

COLS	FORMAT	SUGGESTED VALUE	DESCRIPTION
1-10	xxxxxxx.xx	0.00	R&D 8 periods ago
11-20	xxxxxxx.xx	0.00	R&D 7 periods ago
21-30	xxxxxxx.xx	0.00	R&D 6 periods ago
31-40	xxxxxxx.xx	0.00	R&D 5 periods ago
41-50	xxxxxxx.xx	0.00	R&D 4 periods ago
51-60	xxxxxxx.xx	0.00	R&D 3 periods ago
61-70	xxxxxxx.xx	0.00	R&D 2 periods ago
71-80	xxxxxxx.xx	0.00	R&D 1 period ago

CARD 4

COLS	FORMAT	SUGGESTED VALUE	DESCRIPTION
1-10	xxxxxxx.xx	0.00	Cap. exp. 8 periods ago
11-20	xxxxxxx.xx	0.00	Cap. exp. 7 periods ago
21-30	xxxxxxx.xx	0.00	Cap. exp. 6 periods ago
31-40	xxxxxxx.xx	0.00	Cap. exp. 5 periods ago
41-50	xxxxxxx.xx	0.00	Cap. exp. 4 periods ago
51-60	xxxxxxx.xx	0.00	Cap. exp. 3 periods ago
61-70	xxxxxxx.xx	0.00	Cap. exp. 2 periods ago
71-80	xxxxxxx.xx	0.00	Cap. exp. 1 period ago

CARD 5

COLS	FORMAT	SUGGESTED VALUE	DESCRIPTION
			Fraction of R&D to production
1-10	xxxxxxx.xx	0.50	8 periods ago
11-20	xxxxxxx.xx	0.50	7 periods ago
21-30	xxxxxxx.xx	0.50	6 periods ago
31-40	xxxxxxx.xx	0.50	5 periods ago
41-50	xxxxxxx.xx	0.50	4 periods ago
51-60	xxxxxxx.xx	0.50	3 periods ago
61-70	xxxxxxx.xx	0.50	2 periods ago
71-80	xxxxxxx.xx	0.50	1 period ago

FOR FIRM 2

CARDS 6-10

FOR FIRM 3

CARDS 11-15

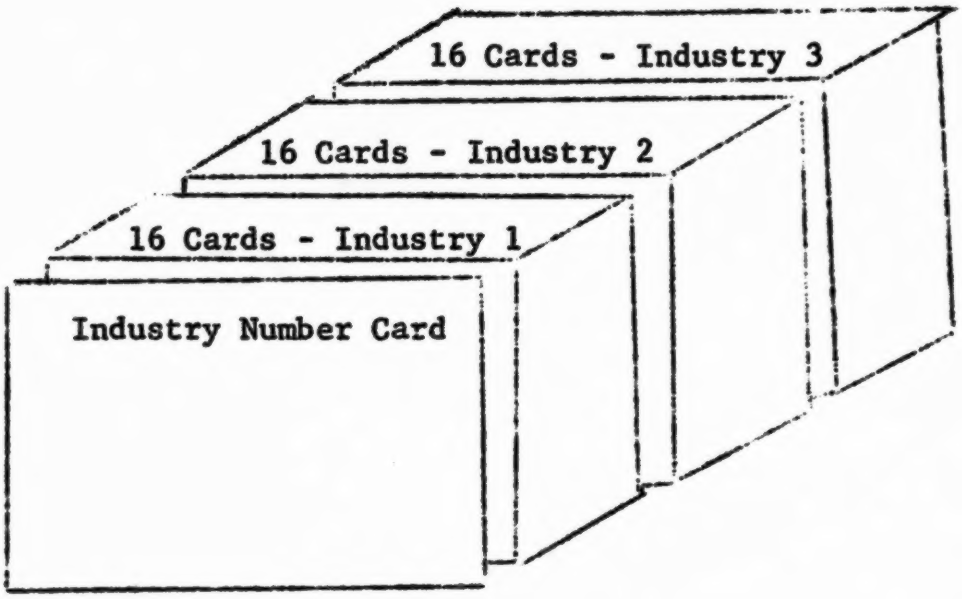
FOR THE INDUSTRY

CARD 16

COLS	FORMAT	SUGGESTED VALUE	DESCRIPTION
1-2	xx	27	Number used in random number generator
3-4	xx	1	Period number
5-6	xx	none	Industry number
7-10	xxxx	4000	Trend value

This set of sixteen cards is repeated for each industry. Preceding the data for the first firm of the first industry should be a card in which the number of industries for which the history tape is being created is punched in columns 1 and 2.

The data deck for a three industry game would look like Figure 12.


16 Cards - Industry 3
16 Cards - Industry 2
16 Cards - Industry 1
Industry Number Card

INITIALIZER Program Listing

```
 MON$$      JOB  INITIALIZER  LBE KREJEWSKI
 NON$$      MODE GO,TEST
 MON$$      ASGN MJB,12
 MON$$      ASGN MW1,11
 MON$$      ASGN MW2,12
 MON$$      ASGN MGO,14
 MON$$      EXEQ FORTRAN,,,6,,,,MAINPGM
   DIMENSION RD(3,8), CE(3,8), CP(3,8), PNL(3),BV(3), PFRAC(3),
  1S(3), TINYI(3), PPIV(3), AR(3), BHAT(3), AHAT(3), CASHIN(3)
10 FORMAT(I2)
11 FORMAT( 8F10.2)
12 FORMAT(8F10.2)
13 FORMAT(I2,F2.0,F2.0,F4.0)
14 FORMAT(1H1, 50X,4HGAME,2X,F3.0///)
15 FORMAT(1H ,28X,12HLINES AVAIL.,8X,6HSALES,8X,9HPHYS.  INV,8X,
  19HINVENTORY,8X,3HA/R,8X,4HDEBT,//)
16 FORMAT(1H ,I1,29X,F10.2,6X,F10.2, 6X,F10.2,6X,F10.2,4X,F10.2,
  13X,F10.2)
17 FORMAT(///////1H ,13X,12HFRAC OF MART,20X,6HINVEST,20X,
  19HPREV CASH,20X,8HBOOK VAL,//)
18 FORMAT(1H , I1, 14X,F10.2,18X,F10.2,19X,F10.2,18X,F10.2)
19 FORMAT(/////1H ,20X,8HPERIOD =.F3.0,20X,15HRANDOM NUMBER =,I3,
  120X,7HTREND =,F5.0//////)
20 FORMAT(1H ,50X,15HFRAC TO R AND D,//)
21 FORMAT(1H , I1,8F14.2)
22 FORMAT(///1H ,50X,7HR AND D,//)
23 FORMAT(///1H ,44X,19HCAPITAL EXPENDITURE,//)
   REWIND 4
   READ(1,10) N
   DO 100 J=1,N
   DO 200 K=1,3
   READ(1,11) PNL(K), BV(K), PFRAC(K), TINYI(K), PPIV(K),
  1AR(K), BHAT(K), AHAT(K), CASHIN(K)
200 READ(1,12) (RD(K,L),L=1,8) ,(CE(K,LL),LL=1,8), (CP(K,L3),L3=1,8)
   READ(1,13) ISUBO,PER, GTEST, TREND
   WRITE(4)    RD,CE,PNL,PFRAC,CP,S,TINYI,PPIV,AR,BHAT,AHAT,CASHIN,
  1BV,PER,ISUBO,GTEST,TREND
   WRITE(3,14) GTEST
   WRITE(3,15)
   DO 300 K=1,3
300 WRITE(3,16) K,PNL(K),S(K),TINYI(K),PPIV(K),AR(K),BHAT(K)
   WRITE(3,17)
   DO 400 K=1,3
```

```
400 WRITE(3,18) K,PFRAC(K),AHAT(K),CASHIN(K), BV(K)
    WRITE(3,19) PER,ISUBO,TREND
    WRITE(3,20)
    DO 500 K=1,3
500 WRITE(3,21) K,CP(K,1),CP(K,2),CP(K,3),CP(K,4),CP(K,5),CP(K,6)
   1CP(K,7),CP(K,8)
    WRITE(3,22)
    DO 600 K=1,3
600 WRITE(3,21) K,RD(K,1),RD(K,2),RD(K,3),RD(K,4),RD(K,5),RD(K,6),
   1RD(K,7),RD(K,8)
    WRITE(3,23)
    DO 700 K=1,3
700 WRITE(3,21) K,CE(K,1),CE(K,2),CE(K,3),CE(K,4),CE(K,5),CE(K,6),
   1CE(K,7),CE(K,8)
100 CONTINUE
    GTEST = 99.0
    WRITE(4)    RD,CE,PNL,PFRAC,CP,S,TINYI,PPIV,AR,BHAT,AHAT,CASHIN,
   1BV,PER,ISUBO,GTEST,TREND
    END FILE 4
    REWIND 4
    STOP
    END
  MON$$       EXEQ LINKLOAD
              CALL MAINPGM
  MON$$       EXEQ MAINPGM,MJB
```

GAME: Operating Instruction and Program Listing

There are three types of control cards which CAN be used during a game play. They are

The BLANK Card

A BLANK card signifies the end of processing and should be included after the decision card for the last industry.

The ONE Card

The ONE card has a 1 punched in the first column and signifies that same constant changes are to be made for that industry. The ONE card should be followed by two CONSTANT cards. If no ONE card is found the previous constants are assumed.

The TWO Card

This card has a 2 punched in the first column and signifies that the decisions of one of the industries follows and that processing for that industry should commence.

CONSTANT CARD 1

The first CONSTANT CARD has the following format.

COLS	FORMAT	CONSTANT SYMBOL	DESCRIPTION
1-6	xxxxxx	CE_1^o	Critical Cap. Exp. - firm 1
7-12	xxxxxx	CE_2^o	Critical Cap. Exp. - firm 2
13-18	xxxxxx	CE_3^o	Critical Cap. Exp. - firm 3
19-24	xxxxxx	RD_1^o	Critical R&D - firm 1
25-30	xxxxxx	RD_2^o	Critical R&D - firm 2
31-36	xxxxxx	RD_3^o	Critical R&D - firm 3
37-42	xxxxxx	A_1^o	Critical Adv. - firm 1
43-48	xxxxxx	A_2^o	Critical Adv. - firm 2
49-54	xxxxxx	A_3^o	Critical Adv. - firm 3
55-60	xxxxxx	SE_1^o	Critical Selling - firm 1
61-66	xxxxxx	SE_2^o	Critical Selling - firm 2
67-72	xxxxxx	SE_3^o	Critical Selling - firm 3

All numbers must be right justified in their respective fields.

CONSTANT CARD 2

The second CONSTANT card has the following format.

COLS	FORMAT	CONSTANT SYMBOL	DESCRIPTION
1-5	xxxxx	b_k	Trend in national market
6-11	xxxxxx	δ	Random amplitude in national market.
12-17	xxxxxx	m_1	Cyclical amp. in national market.
18-23	xxxxxx	m_7	Market elasticity factor
24-26	x.xx	c_1	Advertising weight
27-29	x.xx	c_2	Selling weight
30-32	x.xx	c_3	R and D weight
33-35	x.xx	c_4	Price weight
36-37	.xx	P_μ	Fraction of accounts not collected
38-39	xx	$\bar{d}_1$	Number of days to collect receivables
40-41	.xx	f	Distributors discount
42-51	x, xxx, xxx, xxx	SD	Total distributor Potential
52-56	xxxxx	β_1	Response coefficient - firm 1
57-61	xxxxx	β_2	Response coefficient - firm 2
62-66	xxxxx	β_3	Response coefficient - firm 3

All numbers must be right justified in their respective fields. Commas and decimal points are understood and not punched.

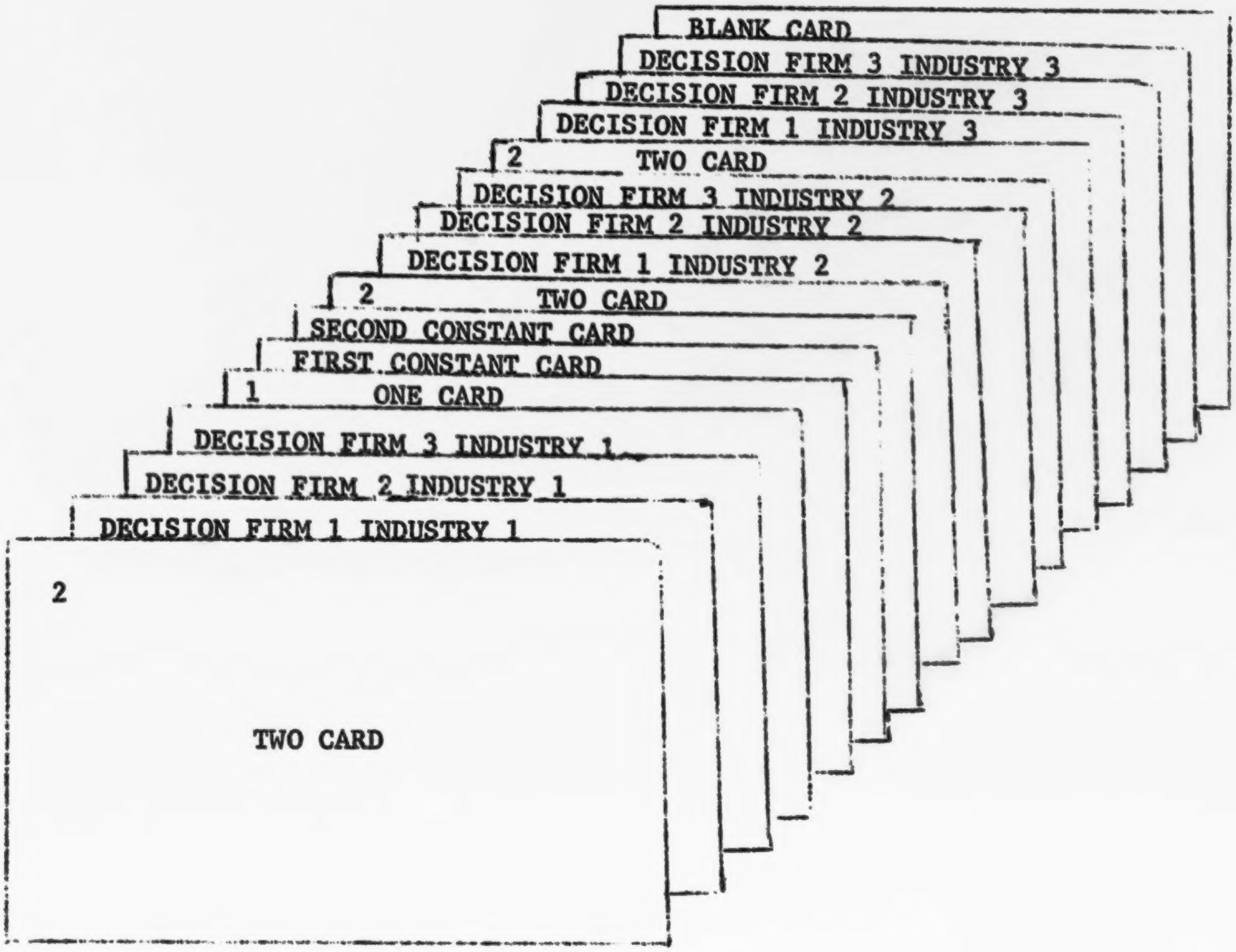
The use of these constants can be seen by reference to the mathematical structure of the game. If the administrator desires to change any other parameters he must do so by changing the program at the onset of the game.

An example of the use of the BLANK, ONE, TWO, AND PARAMETER cards is shown in Figure 13.

FIGURE 13

Situation: 3 Industries to be simulated

Purpose: To change parameters for industry number 2


BLANK CARD
DECISION FIRM 3 INDUSTRY 3
DECISION FIRM 2 INDUSTRY 3
DECISION FIRM 1 INDUSTRY 3
2
TWO CARD
DECISION FIRM 3 INDUSTRY 2
DECISION FIRM 2 INDUSTRY 2
DECISION FIRM 1 INDUSTRY 2
2
TWO CARD
SECOND CONSTANT CARD
FIRST CONSTANT CARD
1
ONE CARD
DECISION FIRM 3 INDUSTRY 1
DECISION FIRM 2 INDUSTRY 1
DECISION FIRM 1 INDUSTRY 1
2
TWO CARD

After industry 2 has been simulated the constants will automatically be changed back to their original values. A "two card" must precede each industry's decisions.

GAME Program Listing

```
   MON$$     JOB  THOMPSON MGT. GAME
   MON$$     MODE GO,TEST
   MON$$     ASGN MW1,11
   MON$$     ASGN MW2,12
   MON$$     ASGN MJB,13
   MON$$     ASGN MGO,14
   MON$$     EXEQ FORTRAN,,,6,,,,MAINPGM
    DIMENSION RD(3,8),CE(3,8),RDIN(3),RDONE(3),CEIN(3),CEONE(3),X(3),
   1BARL(3),PNL(3),CONL(3),D(3),BV(3),F(3),COST(3),PNLIN(3),CS(3),U(3)
   2,AIN(3),AONE(3),A(3),SEIN(3),SEONE(3),PD(3),PFRAC(3),SONE(3),
   3CP(3,8),R(3)
    DIMENSION G(9),RDA(3),Z(9),P(3),TINYF(3), BETA(3),S(3), TINYS(3),
   1TINYI(3),PPIV(3),WC(3),AC(3),AR(3),DELTA(3),BHAT(3),AHAT(3),
   2AHATI(3),BHATI(3),E(3),PROF(3),T(3),TA(3),CASH(3),FW(3),MFIRM(3),
   3CASHIN(3)
    DIMENSION BOROW(3), TINYA(3), SE(3), RELRD(3),V(3)  ,C(3)
800 FORMAT(F1.0)
801 FORMAT(12F6.0)
802 FORMAT(F5.0,3F6.0,4F4.2,F2.2,F2.0,F2.2,F10.0,3F5.0)
803 FORMAT(I1,3F6.0,F5.2,F6.0,2F3.3,2F6.0,F2.0)
804 FORMAT(1H1,40X,24HOPERATING STATEMENT FIRM,I2,8H  PERIOD,F5.0
   1,2X,4HGAME,F5.0//)
805 FORMAT(1H ,30X,5HSALES,5X,F8.0,10X,10HPRODUCTION,10X,F8.0)
806 FORMAT(1H ,30X,5HPRICE,9X,F6.2, 8X,18HPHYSICAL INVENTORY,2X,F8.0)
807 FORMAT(1H ,30X,15HSHARE OF MARKET,F5.2, 8X,24HFRACTION TO DISTRIBU
   1TORS,F6.2)
809 FORMAT(1H ,40X,11HPROFIT-LOSS,//)
808 FORMAT(1H ,30X,13HUNIT MFG COST,F7.2//)
810 FORMAT(1H ,30X,13HSALES REVENUE,33X,F12.2)
811 FORMAT(1H ,30X,23HLESS COST OF GOODS SOLD,23X,F12.2)
812 FORMAT(1H ,30X,12HGROSS MARGIN,34X,F12.2)
813 FORMAT(1H ,30X,23HLESS OPERATING EXPENSES)
814 FORMAT(1H ,33X,15HSELLING EXPENSE,11X,F12.2)
815 FORMAT(1H ,33X,19HADVERTISING EXPENSE,7X,F12.2)
816 FORMAT(1H ,33X,17HWAREHOUSING COSTS,9X,F12.2)
817 FORMAT(1H ,33X,24HRESEARCH EXPENSE TO PROD,2X,F12.2)
818 FORMAT(1H ,33X,10HTO PRODUCT,16X,F12.2)
819 FORMAT(1H ,33X,24HTOTAL OPERATING EXPENSES,19X,F12.2)
820 FORMAT(1H ,79X,12H------------,)
821 FORMAT(1H ,30X,16HOPERATING PROFIT,30X,F12.2//)
822 FORMAT(1H ,30X,25HPLUS NON OPERATING INCOME,)
823 FORMAT(1H ,33X,12HOTHER INCOME,14X,F12.2)
824 FORMAT(1H ,33X,16HINTEREST EXPENSE,10X,F12.2)
825 FORMAT(1H ,33X,24HNET NON OPERATING INCOME,19X,F12.2)
826 FORMAT(1H ,30X,23HNET PROFIT BEFORE TAXES,23X,F12.2)
827 FORMAT(1H ,30X,10HLESS TAXES,36X,F12.2//)
828 FORMAT(1H ,30X,10HNET PROFIT,36X,F12.2)
829 FORMAT(1H ,60X,15HUNFILLED DEMAND,2X,F12.2)
830 FORMAT(1H1,50X,13HCASH POSITION,//)
831 FORMAT(1H ,30X,22HPREVIOUS CASH POSITION,35X,F12.2)
832 FORMAT(1H ,30X,18HACCOUNTS COLLECTED,39X,F12.2)
833 FORMAT(1H ,30X,28HWITHDRAWALS FROM INVESTMENTS,29X,F12.2)
834 FORMAT(1H ,30X,9HNEW LOANS,48X,F12.2)
835 FORMAT(1H ,33X,11HTOTAL COSTS,31X,F12,2)
836 FORMAT(1H ,33X,5HTAXES,37X,F12.2)
837 FORMAT(1H ,33X,20HCAPITAL EXPENDITURES,22X,F12.2)
```

```
  838 FORMAT(1H ,33X,29HNEW INVESTMENTS OR REPAYMENTS,13X,F12.2)
  839 FORMAT(1H ,30X,17HNET CASH POSITION,40X,F12.2)
  840 FORMAT(//1H ,47X,19HBALANCE SHEET ITEMS,//)
  841 FORMAT(1H ,30X,4HCASH,53X,F12.2)
  842 FORMAT(1H ,30X,11HINVESTMENTS,46X,F12.2)
  843 FORMAT(1H ,30X,19HACCOUNTS RECEIVABLE,38X,F12.2)
  844 FORMAT(1H ,30X,15HINVENTORY VALUE,42X,F12.2)
  845 FORMAT(1H ,30X,16HNET FIXED ASSETS,41X,F12.2)
  846 FORMAT(1H ,33X,4HDEBT,38X,F12.2)
  847 FORMAT(1H ,30X,10HNET ASSETS,47X,F12.2)
  848 FORMAT(///1H ,50X,15HMARKET RESEARCH,//)
  849 FORMAT(1H ,47X,26HFIRM 1    FIRM 2    FIRM 3,//)
  850 FORMAT(1H ,25X,5HPRICE,17X,F6.2,4X,F6.2,4X,F6.2)
  851 FORMAT(1H ,25X,15HSELLING EXPENSE,7X,F6.2,4X,F6.2,4X,F6.2)
  852 FORMAT(1H ,25X,16HADVERTISING EXP.,6X,F6.2,4X,F6.2,4X,F6.2)
  853 FORMAT(1H ,25X,17HFRACTION TO DIST.,5X,F6.2,4X,F6.2,4X,F6.2//)
  854 FORMAT(1H ,25X,3HGNP,F7.2,6X,19HDURABLE GOODS INDEX,F5.2)
  855 FORMAT(1H1,30X,12HGAME SUMMARY,3X,6HPERIOD,F3.0,2X,4HGAME,F3.0,
     1//////////)
  856 FORMAT(1H ,8X,5HPRICE,6X,15HSELLING EXPENSE,6X,11HADVERTISING,
     18H EXPENSE,6X,27HRESEARCH EXPENSE TO PRODUCT,6X,8HSHARE OF,
     27H MARKET,//)
  857 FORMAT(1H, 4X, 12,2X,F5.2,5X,F9.2,F7.4,7X,F9.2,F7.4,12X,F9.2,F7.4,
     114X,F4.2)
  858 FORMAT(//////////1H ,5X,20HCAPITAL EXPENDITURES,6X,8HRESEARCH,
     117H EXPENSE TO PROD.,6X,10HPRODUCTION,8X,13HUNIT MFG COST,8X,
     210HNET PROFIT,//)
  859 FORMAT(1H, 4X, 12,4X,F9.2,20X,F9.2,13X,F9.2,13X,F6.2,10X,F11.2)
  899 FORMAT(1H ,30X,12HDEPRECIATION,45X,F12.2)
      PAUSE 9999
      SW1 =0.0
      SW2=0.0
C
C     TYPE  =  0  MEANS END OF DATA
C     TYPE  =  1  MEANS CHANGE EXISTING CONSTANTS TO NEW VALUES
C     TYPE  =  2  MEANS READ IN DECISIONS
C
    9 READ(1,800) TYPE
      IF(TYPE-2.0)10,30,30
   10 IF(TYPE)60,60,11
   11 READ(1,801) (CEONE(I),I=1,3),(RDONE(I),I=1,3),(AONE(I),I=1,3)
     1(SEONE(I),I=1,3)
      READ(1,802) BSUBK,DELT,SM1,SM7,C1,C2,C3,C4,PMUU,DBAR,TINEF,
     1SD,(BETA(I),I=1,3)
      SW1=1
      GO TO 9
C
C
C     READ DECISIONS IN FROM CARD READER
C     MFIRM(K)  =  FIRM NUMBER
C     SEIN(K)  =  SELLING EXPENSE
C     AIN(K)     =  ADVERTISING EXPENSE
C     CEIN(K)    =  CAPITAL EXPENDITURES
C     P(K)       =  PRICE
C     X(K)       =  PRODUCTION
C     PD(K)      =  FRACTION TO DISTRIBUTORS
```

```
C     T(K)       =  FRACTION OF R AND D TO PRODUCTION
C     RDIN(K)    =  R AND D BUDGET
C     DELTA(K)   =  PAYMENTS, INVESTMENT, WITHDRAWALS
C     GAME       =  GAME NUMBER
C
C
   30 DO 35 K=1,3
   35 READ(1,803) MFIRM(K),SEIN(K),AIN(K),CEIN(K),P(K),X(K),PD(K), T(K),
     1RDIN(K),DELTA(K), GAME
      IF(SW1-1.0)40,41,42
C
C
C     INITIALIZATION OF CONSTANTS ROUTINE (THRU STMNT 41)
C     THIS IS DONE ONLY IF NEW CONSTANT VALUES WERE NOT READ IN
C
C     CEONE(K)    =   CRITICAL CAPITAL EXPENDITURES
C     RDONE(K)    =   CRITICAL R AND D
C     AONE(K)     =  CRITICAL ADVERTISING
C     R(K)        =   RAW MATERIALS COST PER UNIT
C     SEONE(K)    =   CRITICAL SELLING
C     BSUBK       =   TREND IN THE NATIONAL MARKET
C     DELT        =   RANDOM AMPLITUDE IN NATIONAL MARKET
C     SM1         =   CYCLICAL AMPLITUDE IN NATIONAL MARKET
C     SM7         =   MARKET ELASTICITY FACTOR
C     C1          =   ADVERTISING WEIGHT
C     C2          =   SELLING WEIGHT
C     C3          =   R AND D WEIGHT
C     C4          =   PRICE WEIGHT
C     PMUU        =   FRACTION OF ACCOUNTS NOT COLLECTED
C     DBAR        =   NUMBER OF DAYS TO COLLECT RECEIVABLES
C     TINEF       =  DISTRIBUTORS DISCOUNT
C     SD          =  TOTAL DISTRIBUTOR POTENTIAL
C     BETA(J)     =  RESPONSE COEFFICIENT
C
   40 DO 39 K=1,3
      CEONE(K) = 30000.0
      RDONE(K) = 37500.0
      AONE(K) = 40000.0
      R(K) = 10.0
   39 SEONE(K) = 120000.0
      BSUBK = 4000.0
      DELT = 20000.0
      SM1 = 10000.0
      SM7 = -16000.0
      C1 = 1.00
      C2 = 1.00
      C3 = 1.00
      C4 = +9.00
      PMUU=0.0
      DBAR = 30.0
      TINEF= .10
      SD = 1080000.0
      DO 46 J=1,3
   46 BETA(J) = 1000.0
      SW1 = 2.0
      GO TO 42
   41 SW1 = 0.0
   42 IF(SW2 - 1.0)43,44,45
C
C     INITIALIZATION OF PARAMETERS ROUTINE (THRU STMNT 44)
C     NEW VALUES CAN BE READ IN WITH A MINOR CHANGE IN THE READ ROUTINE
C
   43 A1 = .00002
      A2 = .000026666666
      A3 = .000025
      A4 = .0000083333333
      PSI = .025
      SM3 = 370000.00
      SM8 = 20.0
      SM4 = .001
      SM5 = 1.6
      SM6 = .00001
      SM2 = 1.570795
      VLAM1 = .0375
      VLAM2 = .05
      AK1 = .01
      AK2 = .015
      D2 = 90.0
      SW2 = 2
      DO 50 K=1,3
      BARL(K) = 18000.0
      CONL(K) = 4.0
      COST(K) = 126000.0
      CS(K) = 5000.0
      BETA(K) = 1000.00
      TA(K) = .52
   50 FW(K) = 10000.0
      Z(1) = .00000072
      Z(2) = .00000072
      Z(3) = .00000070
      Z(4) = .00000068
      Z(5) = .00000063
      Z(6) = .00000058
      Z(7) = .00000052
      Z(8) = .00000046
      G(1) = .000000358
      G(2) = .000000725
      G(3) = .00000132
      G(4) = .00000172
      G(5) = .00000132
      G(6)= .000000725
      G(7) = .000000358
      G(8) =   .00000017
      GO TO 45
   44 SW2 = 0.0
C
C
C     READ PAST HISTORY DATA FROM TAPE UNIT 1
C     ROUTINE EXTENDS THRU STMNT 49
C     S          =  SALES VALUE LAST PERIOD
C     TINYI      =  PHYSICAL INVENTORY LAST PERIOD
C     PPIV       =  INVENTORY VALUE LAST PERIOD
C     AR         =  ACCOUNTS RECEIVABLE LAST PERIOD
```

```
C        BHAT          =  DEBT POSITION AS OF LAST PERIOD
C        AHAT          =  INVESTMENT POSITION AS OF LAST PERIOD
C        BV            =  BOOK VALUE AS OF LAST PERIOD
C        PER           =  LAST PERIOD NUMBER
C        ISUBO         =  NUMBER USED IN RANDOM NUMBER GENERATER
C        GTEST         =  GAME NUMBER
C        TREND         =  TREND FACTOR (CUMULATIVE)
C
C
   45 READ(4)  RD,CE,PNLIN,PFRAC,CP,S,TINYI,PPIV,AR,BHAT,AHAT,CASHIN,
     1 BV,PER,ISUBO,GTEST,TREND
      IF(GTEST-GAME)45,76,47
   47 IF(GTEST-99.0)45,48,48
   48 IF(SW5-1.0)49,70,70
   49 REWIND 4
      GO TO 45
C
C        RD            =  GIVES FULL WEIGHT TO CRITICAL R AND D EXPENDITURES
C        CE            =  GIVES FULL WEIGHT TO CRITICAL CAPITAL EXPENDITURES
C        PNLIN         =  NUMBER OF PRODUCTION LINES IN USE LAST PERIOD
C        PFRAC         =  PREVIOUS FRACTION OF MARKET
C        CP            =  FRACTION OF R AND D TO PRODUCTION
C
   76 DO 90 K=1,3
      RD(K,1) = 0.0
      CE(K,1) = 0.0
      CP(K,1) = 0.0
      DO 89 N=2,8
      RD(K,N-1)=RD(K,N)
   89 CE(K,N-1)=CP(K,N)
      CP(K,8) = T(K)
   90 T(K) = 0.0
      DO 100 K=1,3
      B=A2*(RDIN(K)-RDONE(K))
      RD(K,8)=RDONE(K)*(1.0+ HTAN(B))
      B+A1*(CEIN(K)-CEONE(K))
      CE(K,8) = CEONE(K)*(1.0+HTAN(B))
C
C        UNIT MANUFACTURING COST ROUTINE (THRU STMNT 100)
C
C        PNL           =  NUMBER OF LINES IN OPERATION THIS PERIOD
C        V(K)          =  VARIABLE COST FOR FIRM K
C        D(K)          =  DEPRECIATION FOR FIRM K
C        F(K)          =  FIXED COST FOR FIRM K
C        U(K)          =  UNIT MANUFACTURING COST
C
      IF(X(K))150,150,103
  103 IF(X(K) - 162000.00) 105,105,104
  104 X(K) = 162000.00
  105 SUMA = 0.0
      SUMB = 0.0
      DO 110 N=1,8
      SUMA = SUMA + RD(K,N)*CP(K,N)*G(N)
  110 SUMB = SUMB + CE(K,N)*Z(N)
      TEST = X(K)/BARL(K)
      MTEST = TEST
     FTEST = MTEST
     IF(TEST-FTEST) 120,130,120
120  PNL(K) = MTEST+1
     GO TO 140
130  PNL(K) = MTEST
140  ALL =CONL(K) - (SUMA + SUMB)
     V(K) = R(K) + ALL
150  D(K) = (BV(K) + .5*CEIN(K))*PSI
     BV(K) = (BV(K) + CEIN(K))*(1.0-PSI) + .5*CEIN(K)*PSI
     F(K) = D(K) +COST(K)+ABS(PNL(K) - PNLIN(K))*CS(K)
     IF(X(K)) 155,155,156
155  U(K) = 999.99
     PNL(K)=0.0
     GO TO 100
156  U(K)=V(K)+F(K)/X(K)
100  CONTINUE
     PRDUM=0.0
     DDUM=0.0
     PDUM=0.0
     SDUM=0.0
     RDUM=0.0
     ADUM=0.0
     DO 210 K=1,3
     B = A3*(AIN(K)-AONE(K))
     A(K)=AONE(K) * (1.0+HTAN(B))
     ADUM=ADUM+A(K)
     B = A4*(SEIN(K)-SEONE(K))
     SEK = SEONE(K)*(1.0+HTAN(B))
     SONE(K)=SEK+PD(K)*PFRAC(K)*SD
     SDUM = SDUM + SONE(K)
     DO 200 M=1,8
200  DDUM = DDUM + (1.0-CP(K,M))*G(M)*RD(K,M)
     RDUM = RDUM+DDUM
     RDA(K)=DDUM
     DDUM = 0.0
210  PRDUM=PRDUM+P(K)

C
C    RELATIVE ADVERTISING, SELLING, AND FRACTION OF MARKET ROUTINE
C
C
C    A(K)        =    A STAR FUNCTION FOR FIRM K
C    SEK         =    SELLING STAR FUNCTION FOR FIRM K
C    TINYA(K)    =    RELATIVE ADVERTISING POSITION OF FIRM K
C    SE(K)       =    RELATIVE SELLING POSITION OF FIRM K
C    RELRD(K)     =    RELATIVE R AND D POSITION OF FIRM K
C    PFRAC(K)    =    FRACTION OF MARKET FOR FIRM K
C
C
     DO 220 K=1,3
     TINYA(K)=A(K)/ADUM
     SE(K)=SONE(K)/SDUM
     TSEE=(P(K)/PRDUM)*3.0
     RELRD(K)=RDA(K)/RDUM
     TINYF(K) = PFRAC(K) + BETA(K)*EXP(C1*TINYA(K)+C2*SE(K)+C3*RELRD(K)
    1 - C4*TSEE)
```

```
  220 DDUM = DDUM + TINYF(K)
      DO 230 K=1,3
  230 PFRAC(K) = TINYF(K)/DDUM
C
C
C     RANDOM NUMBER GENERATOR
C
C
      ISUBO = ISUBO*97
      M = ISUBO/100
      Y = ISUBO/100
      YY = M
      Y = Y-YY
      M = Y*100.0
C
C
      TREND = TREND + BSUBK
      HNUU = DELT   (Y-.5)
C
C
C     GNP,DGI,NATIONAL SALES, AND ACCOUNTS COLLECTED
C
C
C     SNAT      =     TOTAL NATIONAL SALES
C     GNP       =    GROSS NATIONAL PRODUCT
C     DGI       =    DURABLE GOODS INDEX
C     AC(K)     =    ACCOUNTS COLLECTED FIRM K
C     TINYS(K) =     PHYSICAL SALES FOR FIRM K
C
C
      W = SIN(SM2*PER)
      SNAT = HNUU + TREND + SM1*W + SM3 + SM7*((PRDUM/3.0)-SM8)
      IF(SNAT) 240,250,250
  240 SNAT = 0.0
  250 GNP = SM4*(SM3 + HNUU + TREND)
      DGI = SM5 + SM6*SM1*W
      DO 300 K=1,3
      AC(K)=DBAR*S(K)
  300 TINYS(K) = PFRAC(K)*SNAT
C
C
C     FULFILLMENT DETERMINATION ROUTINE    (THRU STMNT 470)
C     DETERMINE FIRM K@S ABILITY TO FILL ITS SALES ORDERS
C
C     UNDEM    =   UNFULFILLED DEMAND
C
      UNDEM=0.0
      J = 2
      JJ = 3
      JJJ = 3
      DO 470 K=1,3
      TESTS = TINYI(K) + X(K)
      IF( TINYS(K)-TESTS) 450,450,400
  400 XSALE = TINYS(K)-TESTS
      TINYS(K) = TESTS
      SUM = PFRAC(J) + PFRAC(JJ)
      EXCES = XSALE* (P-RAC(J)/SUM)
      TINYS(J)  =  TINYS(J)  +  EXCES
      TINYS(JJ) =  TINYS(JJ)  +  XSALE - EXCES
      TESTS  =  TINYI(J)  +  X(J)
      IF(TINYS(J)-TESTS)420,420,410
  410 XSALE  =  TINYS(J)-TESTS
      TINYS(J)=TESTS
      TINYS(JJ)=TINYS(JJ)+XSALE
  420 TESTS=TINYI(JJ)+X(JJ)
      IF(TINYS(JJ)-TESTS)460,460,430
  430 TINYS(J)=TINYS(J)  +  TINYS(JJ)-TESTS
      TINYS(JJ)  =  TESTS
      TESTS  =  TINYI(J)  +  X(J)
      IF(  TINYS(J)-TESTS)460,460,440
  440 UNDEM  =  TINYS(J)-TESTS
      TINYS(J)=TESTS
  460 DO  465  M=1,3
  465 PFRAC(M)=  TINYS(M)/SNAT
      GO TO 500
  450 JJ = J+1
      J  =  JJJ-(K+1)
      JJJ  =  JJ+1
  470 CONTINUE
C
C
C     CALCULATE COST OF GOODS SOLD, PHYSICAL INVENTORY, INVENTORY VALUE
C     WAREHOUSING COST, SALES REVENUE, ACCOUNTS RECEIVABLE(THRU  STM 510
C
C     C(K)      =  COST OF GOODS SOLD FOR FIRM K
C     VW        =  VARIABLE WAREHOUSING COST
C     WC(K)     =  WAREHOUSING COSTS FOR FIRM K
C     S(K)      =  SALES REVENUE OF FIRM K
C     AC(K)     =  ACCOUNTS COLLECTABLE
C     AR(K)     =  ACCOUNTS RECEIVABLE
C
C
  500 DO  510  K=1,3
      ZZ  =  PPIV(K)  +  X(K)*U(K)
      ZZZ  =TINYI(K)  +  X(K)
      TINYI(K)  =  TINYI(K)+X(K)-TINYS(K)
      Z4  =  PPIV(K)
      PPIV(K)  =  ZZ*(ZZZ-TINYS(K))/ZZZ
      C(K)=TINYS(K)*ZZ/ZZZ
      BARI=(Z4+PPIV(K))/2.0
      VW=(VLAMI*PD(K)+VLAM2* (1.0-PD(K)))
      WC(K)  =  FW(K)  +  VW*BARI
      S(K)=((1.0-PD(K))+(1.0-TINEF)*PD(K))*P(K)*PFRAC(K)*SNAT
      AC(K)  =  AR(K)  +  (D2  -  DBAR)*S(K)/D2
      IF(CASHIN(K)  -  DELTA(K))  509,510,510
  509 DELTA(K)  =  CASHIN(K)
  510 AR(K)  =  AR(K)  +  S(K)-AC(K)
C
C
C     DETERMINE INVESTMENT AND DEBT POSITION ROUTINE (THRU STMNT 685)
C     BHAT(K)  =  DEBT POSITION OF FIRM K
C     AHAT(K)  =  INVESTMENT POSITION OF FIRM K
C     CASHIN   =  PREVIOUS CASH BALANCE
```

```
C
C
      DO  699 K=1,3
      IF (DELTA(K))660,660,610
  610 TEST=BHAT(K)-DELTA(K)
      IF(TEST)620,620,630
  620 BHAT(K)=0.0
      GO TO 640
  630 BHAT(K)=TEST
  640 IF(TEST)650,690,690
  650 AHAT(K)=AHAT(K)-TEST
      GO TO 690
  660 TEST=ABS(DELTA(K))-AHAT(K)
      IF(TEST)680,680,670
  670 BHAT(K)=BHAT(K)+TEST
  680 IF(TEST)685,681,681
  681 AHAT(K)=0.0
      GO TO 690
  685 AHAT(K) = TEST*(-1.0)
C
C
C     PROFIT,TAX,EXPENSE, CASH POSITION ROUTINE (THRU STMNT 699)
C
C     AHATI(K) = INCOME FROM INVESTMENTS
C     BHATI(K) = INTEREST EXPENSE
C     E(K)     = EXPENSES
C     PROF(K)  = PROFITS
C     T(K)     = TAXES
C     CASH(K)  = NEW CASH POSITION
C     BOROW(K) = AMOUNT OF NEW LOANS INCURRED
C
C
      VW = VW
  690 AHATI(K)=AK1*AHAT(K)
      BHATI(K)=AK2*BHAT(K)
      E(K) = C(K) + RDIN(K) + SEIN(K) + AIN(K) + WC(K) + BHATI(K)
      PROF(K)=S(K)+AHATI(K)-E(K)
      T(K)=TA(K)*PROF(K)
      CASH(K)=CASHIN(K)-DELTA(K)+AC(K)-U(K)*X(K)-RDIN(K)-SEIN(K)
     1-AIN(K)-CEIN(K)+D(K)-WC(K)-T(K)
      IF(CASH(K)) 691,692,692
  691 BOROW(K) =-CASH(K)
      GO TO 693
  692 BOROW(K)=0.0
  693 CASH(K)=CASH(K)+BOROW(K)
      AHAT(K)=(1.0+AK1)*AHAT(K)
  699 BHAT(K)=(1.0+AK2)*BHAT(K)+BOROW(K)
C
C
C     WRITE TAPE ROUTINE --- OUTPUT ON TAPE DRIVE 2 TO BE USED AS
C     INPUT NEXT PERIOD (THRU STMNT 71)
C
C
      PER = PER +1.0
      GO TO 70
   60 GTEST = 99.0
      SW5 = 1.0
   70 WRITE (5) RD,CE,PNL,PFRAC,CP,S,TINYI,PPIV,AR,BHAT,AHAT,CASH.
     1 BV, PER,M,GTEST,TREND
      PER = PER - 1.0
      IF (SW5-1.0)900,71,71
   71 END FILE 5
      REWIND 5
      STOP
C
C
C     PRINT ROUTINE (THRU STMNT 955)
C
C
  900 DO 990 K=1,3
      WRITE (3,804)MFIRM(K),PER,GAME
      WRITE (3,805)TINYS(K),X(K)
      WRITE (3,806) P(K),TINYI(K)
      WRITE (3,807) PFRAC(K), PD(K)
      WRITE (3,808) U(K)
      WRITE (3,809)
      WRITE (3,810) S(K)
      WRITE (3,811) C(K)
      GM=S(K)-C(K)
      WRITE (3,812) GM
      WRITE (3,813)
      WRITE (3,814) SEIN(K)
      WRITE (3,815) AIN(K)
      WRITE (3,816) WC(K)
      Q1 = WC(K)
      WC(K)=CP(K,8)*RDIN(K)
      WRITE (3,817) WC(K)
      WC(K)=RDIN(K)-WC(K)
      WRITE (3,818) WC(K)
      TOTXP = E(K)-BHATI(K) - C(K)
      WRITE (3,819) TOTXP
      WRITE (3,820)
      OPROF = GM - TOTXP
      WRITE (3,821) OPROF
      WRITE (3,822)
      WRITE (3,823) AHATI(K)
      WRITE (3,824) BHATI(K)
      OPNET = AHATI(K)-BHATI(K)
      WRITE (3,825) OPNET
      WRITE (3,820)
      WRITE (3,826) PROF(K)
      PROF(K)=PROF(K)-T(K)
      WRITE (3,827) T(K)
      WRITE (3,828) PROF(K)
      WRITE (3,820)
      WRITE (3,820)
      IF(UNDEM)950,950,940
  940 WRITE (3,829) UNDEM
  950 WRITE (3,830)
      WRITE (3,831) CASHIN(K)
      WRITE (3,832) AC(K)
      WRITE (3,899) D(K)
      IF(DELTA(K)) 951,952,952
```

```
951   DSUBK1 = DELTA(K)
      DSUBK2 = 0.0
      GO TO 953
952   DSUBK1 = 0.0
      DSUBK2 = DELTA(K)
953   WRITE (3,833) DSUBK1
      WRITE (3,834) BOROW(K)
      TOTCOS=U(K)*X(K)+RDIN(K)+SEIN(K)+AIN(K)+Q1
      WRITE (3,835) TOTCOS
      WRITE (3,836) T(K)
      WRITE (3,837) CEIN(K)
      WRITE (3,838) DSUBK2
      WRITE (3,839) CASH(K)
      WRITE (3,840)
      WRITE (3,841) CASH(K)
      WRITE (3,842) AHAT(K)
      WRITE (3,843) AR(K)
      WRITE (3,844) PPIV(K)
      WRITE (3,845) BV(K)
      WRITE (3,846) BHAT(K)
      ASSETS = CASH(K)+AHAT(K)+AR(K)+PPIV(K)+BV(K)-BHAT(K)
      WRITE (3,847) ASSETS
      WRITE (3,848)
      WRITE (3,849)
      WRITE (3,850) P(1),P(2),P(3)
      Q1=SEIN(1)/1000.0
      Q2=SEIN(2)/1000.0
      Q3=SEIN(3)/1000.0
      WRITE (3,851) Q1,Q2,Q3
      Q1=AIN(1)/1000.0
      Q2=AIN(2)/1000.0
      Q3=AIN(3)/1000.0
      WRITE (3,852) Q1,Q2,Q3
      WRITE (3,853) PD(1), PD(2), PD(3)
990   WRITE (3,854) GNP,DGI
      WRITE (3,855) PER  , GAME
      WRITE (3,856)
      DO 954 K=1, 3
      WRITE (3,857) K, P(K), SEIN(K), SE(K), AIN(K), TINYA(K), WC(K),
     1RELRD(K), PFRAC(K)
954   WC(K)=RDIN(K)-WC(K)
      WRITE (3,858)
      DO 955 K=1, 3
955   WRITE (3,859) K,CEIN(K), WC(K), X(K), U(K), PROF(K)
      GO TO 9
      END
     MON$$        EXEQ FORTRAN,,,6,,,HTAN
      FUNCTION HTAN(B)
      HTAN      = (EXP(B)-EXP(-B))/(EXP(B)+EXP(-B))
      RETURN
      END
     MON$$        EXEQ LINKLOAD
                  CALL MAINPGM
     MON%%        EXEQ MAINPGM,MJB
```